HAZARDOUS WASTE MANAGEMENT FACILITY STANDARDIZED PERMIT

U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue, Suite 155, MS 15-H04
Seattle, Washington 98101

Issued in accordance with the Resource Conservation and Recovery Act (RCRA) as amended, 42 U.S.C. §6901 et. seq., and the Hazardous and Solid Waste Amendments of 1984 (HSWA), and the regulations promulgated thereunder in Title 40 of the Code of Federal Regulations (CFR) Parts 124 and 260 through 271).

ISSUED TO: HILCORP NORTH SLOPE, LLC
EPA I.D. No.: AKD 00064 3239

This Permit is effective as of September 30, 2021, and shall remain in effect through September 29, 2031, unless revoked and reissued under 40 CFR § 270.41, or terminated under 40 CFR § 270.43, or continued in accordance with 40 CFR § 270.51(a) [40 CFR § 270.260]. This Permit will be reviewed five (5) years after the date of issuance, in accordance with Section 3005(c)(3) of RCRA, 42 U.S.C. §6925(c)(3), and 40 CFR § 270.50, and will be modified as necessary to assure that the facility continues to comply with the currently applicable requirements of Sections 3004 and 3005 of RCRA, 42 U.S.C. §§6924 and 6925.

ISSUED BY: The U.S. ENVIRONMENTAL PROTECTION AGENCY

Hamlin, Timothy
Digitally signed by Hamlin, Timothy
Date: 2021.08.30 09:09:29 -07'00'

Timothy B. Hamlin, Director
Land, Chemicals and Redevelopment Division
U.S. Environmental Protection Agency, Region 10

August 30, 2021
Date

Hilcorp North Slope, LLC Hazardous Waste Process Facility
2021 RCRA Hazardous Waste Standardized Permit

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FIGURE 1: Hazardous Waste Process Facility Floor Plan

ATTACHMENT A: Locator Map and Site Maps

ATTACHMENT B: List of Allowable Waste

ATTACHMENT C: Hazardous Waste Process Facility Closure Plan

MODULE I - GENERAL PERMIT CONDITIONS

I.A. EFFECT OF PERMIT

The Permittee is allowed to store and non-thermally treat hazardous waste in accordance with the conditions of this Permit. Any storage and/or treatment of hazardous waste not authorized in this Permit is prohibited. Subject to 40 CFR 270.4, compliance with this Permit generally constitutes compliance, for purposes of enforcement, with Subtitle C of RCRA. Issuance of this Permit does not convey any property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations. Compliance with the terms of this Permit does not constitute a defense to any order issued or any action brought under Sections 3008(a), 3008(h), 3013, or 7003 of RCRA; Sections 106(a), 104, or 107 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. 9601 et seq., commonly known as CERCLA), or any other law providing for protection of public health or the environment. [40 CFR 270.4, 270.30(g)]

I.B. PERMIT ACTIONS

I.B.1. Permit Modification

This Permit may be modified for routine changes, routine changes with prior approval, and significant changes in accordance with the requirements at 40 CFR 270.320, 124.211 through 124.214, and 270.41.

I.B.2. Permit Revocation and Re-issuance, and Termination

This Permit may be revoked and reissued, or terminated for cause, as specified in 40 CFR 270.41 and 270.30(f). The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee, does not stay the applicability or enforceability of any permit condition. [40 CFR 124.5(c), 270.4(a), 270.30(f) and 270.41]

I.B.3. Permit Renewal

This Permit may be renewed as specified in 40 CFR 270.30(b) and Permit Condition I.E.2. Review of any application for a Permit renewal shall consider improvements in the state of control and measurement technology, as well as changes in applicable regulations. [40 CFR 270.30(b) and HSWA Sec. 212]

I.C. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit, or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby. [40 CFR 124.16(a)]

I.D. DEFINITIONS

For the purposes of this Permit, terms used herein shall have the same meaning as those in 40 CFR parts 124, 260, 266, 267, 268, and 270, unless this Permit specifically provides otherwise. Where terms are not defined in the regulations or the Permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

"Director" means the Regional Administrator of the EPA Region 10, or his/her designee or authorized representative.

"Prudhoe Bay Unit" is defined as an onshore oil and gas field that occupies approximately 397 square miles on the North Slope of Alaska that is currently used for development and production of oil and gas.

"Facility" means the Prudhoe Bay facility, which is any land or operation within the Prudhoe Bay Unit as documented in Attachment A (Locater Map and Site Maps). The Prudhoe Bay facility generates and stores hazardous wastes related to oil and gas production including spent solvents, methanol, spent acids, biocides, and hydraulic fluids.

"Hazardous Waste Process Facility" or "HWPF" means the 3,000 square foot building located within the Prudhoe Bay facility where hazardous waste is stored and non-thermally treated in containers. (Figure 1. Hazardous Waste Process Facility Floor Plan)

I.E. DUTIES AND REQUIREMENTS

I.E.1. Duty to Comply

The Permittee shall comply with all conditions of the Permit, except to the extent and for the duration that noncompliance is authorized by an emergency Permit. Any Permit noncompliance, other than noncompliance authorized by an emergency Permit, constitutes a violation of RCRA and is grounds for enforcement action; for Permit termination, revocation and reissuance, or modification; or for denial of a Permit renewal application. [40 CFR 270.30(a)]

I.E.2. Duty to Reapply

If the Permittee wishes to continue an activity allowed by this Permit after the expiration date of this Permit, the Permittee shall submit a complete application for a new Permit at least 180 days prior to the Permit expiration. [40 CFR 270.10(h) and 270.30(b)]

I.E.3. Permit Expiration

Pursuant to 40 CFR 270.50, this Permit shall be effective for a fixed term not to exceed ten years. As long as EPA is the Permit-issuing authority, this Permit and all conditions herein will remain in effect beyond the Permit's expiration date if the Permittee has submitted a timely, complete notice of intent under 40 CFR 124.202(b) requesting coverage under a RCRA standardized Permit and, through no fault of the Permittee, the Director has not issued a new permit, as set forth in 40 CFR 270.51. If the Director deems that the Permittee is not eligible for a standardized permit, the conditions of the expired permit will continue. [40 CFR 270.50 and 270.51]

If the Permittee is no longer deemed to be eligible for a standardized permit, the Permittee shall provide to the Director a RCRA permit application in accordance with the applicable requirements for 40 CFR Parts 264 and 270.

I.E.4. Need to Halt or Reduce Activity Not a Defense

The Permittee shall not use as a defense that the Permittee must reduce permitted activities in order to maintain compliance with the conditions of the Permit in the event of an enforcement action. [40 CFR 270.30(c)]

I.E.5. Duty to Mitigate

In the event of noncompliance with the Permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures that are reasonable to prevent significant adverse impacts on human health or the environment. [40 CFR 270.30(d)]

I.E.6. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit, in accordance with 40 CFR 270.30(e).

I.E.7. Duty to Provide Information

The Permittee shall furnish to the Director, within a reasonable time, any relevant information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit, pursuant to 40 CFR 267.72(a) and 270.30(h).

I.E.8. Inspection and Entry

Pursuant to 40 CFR 270.30(i), the Permittee shall allow the Director, or an authorized representative to have entry to the facility, have access to records, and to conduct sampling.

I.E.9. Monitoring and Records

The Permittee shall comply with the requirements for gathering and maintaining monitoring information at 40 CFR 270.30(j).

I.E.10. Reporting Planned Changes

The Permittee shall give notice to the Director, as soon as possible, of any planned physical alterations or additions to the permitted facility. [40 CFR 270.30(l)(1)]

I.E.11. Reporting Anticipated Noncompliance

The Permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. [40 CFR 270.30(l)(2)]

I.E.12. Certification of Unit Modification

The Permittee may not treat or store hazardous waste in any modified portion of the facility until the Permittee has submitted to the Director, by certified mail or hand delivery, a letter signed by the Permittee and a registered professional engineer stating that the facility has been constructed or modified in compliance with the Permit; and followed the remaining requirements at 40 CFR 270.30(l)(2).

I.E.13. Transfer of Permits

This Permit is not transferable to any person except after notice to the Director. A change in the ownership or operational control of the facility shall be made through a routine change with prior written approval submitted to the Director, in accordance with 40 CFR 124.213. [40 CFR 270.30(l)(3), 270.40]

I.E.14. Twenty-four Hour Reporting

The Permittee shall report to the Director any noncompliance which may endanger health or the environment and comply with 40 CFR 270.30(l)(6).

I.E.15. Other Noncompliance

The Permittee shall report all instances of noncompliance not reported under Permit Conditions I.E.10 through I.E.14, at the time monitoring reports are submitted. The reports shall contain the information listed in Permit Condition I.E.14, as per 40 CFR 270.30(l)(10).

I.E.16. Other Information

Whenever the Permittee becomes aware that they failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, the Permittee shall comply with 40 CFR 270.30(l)(11).

I.F. SIGNATORY REQUIREMENT

All applications, reports, or information submitted to or requested by the Director, his designee, or authorized representative, shall be signed and certified in accordance with 40 CFR 270.11 and 270.30(k).

I.G. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE DIRECTOR

All reports, notifications, or other submissions which are required by this Permit to be sent or given to the Director shall be sent by certified mail or given to:

Hilcorp North Slope Project Manager
RCRA Corrective Action, Permits and PCB Section
Land, Chemicals and Redevelopment Division
U.S. EPA Region 10
1200 Sixth Avenue, Suite 155, MS 15-H04
Seattle, WA 98101

I.H. GENERAL DOCUMENTS AND INFORMATION TO BE MAINTAINED AT THE FACILITY

The Permittee shall maintain at the facility or other accessible location as designated by the Director, until closure is completed and certified by an independent, registered professional engineer, the materials listed at 40 CFR 270.290.

I.I. UNIT-SPECIFIC INFORMATION TO BE MAINTAINED AT THE FACILITY

I.I.1. Container-Specific Information to be Maintained at the Facility

The Permittee shall maintain at the facility or other accessible location as designated by the Director, until closure is completed and certified by an independent, registered professional engineer, container-specific documents and information and all amendments, revisions and modifications to these documents and information as listed at 40 CFR 270.300.

I.I.2 Tank-Specific Information to Be Maintained at the Facility

Not Applicable.

I.J. EQUIPMENT INFORMATION TO BE MAINTAINED AT THE FACILITY

Not applicable.

I.K. AIR EMISSION CONTROL INFORMATION TO BE MAINTAINED AT THE FACILITY

The Permittee shall maintain at the facility or other accessible location as designated by the Director, until closure is completed and certified by an independent, registered professional engineer, the air emission control documents and information and all amendments, revisions and modifications to these documents and information as required by 40 CFR 270.315.

MODULE II - DESCRIPTION OF THE FACILITY AND OWNERSHIP

II.A. OWNER

The owner of the land underlying the facility is the State of Alaska, as administered by the Alaska Department of Natural Resources, herein referred to as the "owner". [40 CFR 270.13]

II.B. OPERATOR

The operator of the facility is Hilcorp North Slope, LLC ("Permittee" or "Hilcorp"). Hilcorp operates the facility on behalf of the owners of the Prudhoe Bay Unit. [40 CFR 270.13]

II.C. LOCATION

II.C.1. Location of Facility

The facility is located in the North Slope Borough on the North Slope of Alaska at Prudhoe Bay, adjacent to the town of Deadhorse, Alaska. The facility location is shown on a site vicinity map contained in Attachment A. The organizational address for the Permittee is:

Hilcorp North Slope, LLC
3800 Centerpoint Drive, Suite 1400
Anchorage, Alaska 99503

II.C.2. Facility Layout Map

Site maps showing the layout of the facility and the location of its HWPF (the RCRA storage unit) are provided in Attachment A.

MODULE III - GENERAL FACILITY CONDITIONS

III.A. DESIGN AND OPERATION OF FACILITY

The Permittee shall design, construct, maintain, and operate the facility as specified in 40 CFR 267.31.

III.B. GENERAL WASTE ANALYSIS

The Permittee shall follow the waste analysis requirements of 40 CFR 267.13, and as described in the Waste Analysis Plan.

III.C. SECURITY

The Permittee shall prevent, and minimize the possibility for, livestock and unauthorized people from entering the active portion of the facility, pursuant to 40 CFR 267.14.

III.D. GENERAL INSPECTION REQUIREMENTS

The Permittee shall conduct inspections, record keeping, and remedy of problems, according to 40 CFR 267.15.

III.E PERSONNEL TRAINING

The Permittee shall ensure that the training requirements of 40 CFR 267.16 are met.

III.F. SPECIAL PROVISIONS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE

The Permittee shall take precautions when managing ignitable or reactive waste by following the requirements of 40 CFR 267.17.

III.G. LOCATION STANDARDS

The Permittee shall ensure the location standards of 40 CFR 267.18 are met.

III.H. PREPAREDNESS AND PREVENTION

III.H.1. General Design and Operation Standards

The facility shall be designed, constructed, maintained, and operated in a manner meeting the requirements of 40 CFR 267.31.

III.H.2. Required Equipment

The Permittee shall ensure that the facility will be equipped to meet the requirements of 40 CFR 267.32.

III.H.3. Testing and Maintenance of Equipment

The Permittee shall test and maintain all the required facility equipment specified at 40 CFR 267.33.

III.H.4. Access to Communications or Alarm Systems

The Permittee shall ensure that all personnel shall have immediate access to an internal alarm system or emergency communications device as required by 40 CFR 267.34.

III.H.5. Required Aisle Space

Aisle space shall be maintained according to the requirements of 40 CFR 267.35.

III.H.6. Arrangements with Local Authorities

Arrangements and agreements shall be made with local authorities according to 40 CFR 267.36.

III.I. CONTINGENCY PLAN AND EMERGENCY PROCEDURES

The Permittee shall have a contingency plan and emergency procedures meeting the applicable requirements of 40 CFR 267 subpart D. The Permittee shall notify EPA in writing within five calendar days of whenever the contingency plan and/or emergency procedures are implemented.

III.J. RECORDKEEPING, REPORTING AND NOTIFICATION (40 CFR 267 Subpart E)

The Permittee shall comply with the applicable manifest requirements of 40 CFR Part 262 and 40 CFR 267.70 through 267.72.

III.J.1. Recordkeeping

The Permittee shall keep a written operating record at the facility, until facility closure, as specified at 40 CFR 267.73**.**

III.K. CLOSURE

The Permittee shall obtain clean closure of the facility in compliance with 40 CFR 267 Subpart G and the Permittee's Closure Plan (Attachment C). If clean closure is not obtainable, the Permittee shall obtain an individual post-closure permit separate from this Permit. In the event that operating plans, facility design, or the approved closure plan changes during operation of the permitted facility, a written request for a permit modification shall be submitted to EPA at least 60 days prior to implementing the change. [40 CFR 267.110, 40 CFR 267.112(c)]

MODULE IV - CONTAINERS, TANKS, AND CONTAINMENT BUILDINGS

IVa CONTAINERS

IVa.A. GENERAL DESCRIPTION

The Permittee shall manage and/or store hazardous waste in containers in the HWPF that is the designated container storage area (CSA) specified in Table IVa-1. The Permittee shall not manage and/or store hazardous waste in excess of the maximum capacity for the HWPF identified in Table IVa-1.

TABLE IVa-1
Prudhoe Bay Hazardous Waste Process Facility
Waste Types and Design Capacity

TYPE OF STORAGE (Area)	EPA HAZARDOUS WASTE TYPE	DIMENSIONS (ft) AREA (sq ft)	MAXIMUM VOLUME OF WASTE (gal)/ MAXIMUM NUMBER OF DRUMS
CSA Allowing Liquid and Solid Waste			
Hazardous Waste Process Facility	**Wastes allowed to be managed and stored, including EPA waste codes, are listed in Attachment B to this Permit.**	**60ft x 50ft Area: 3000 sq ft**	**24,420 gallons/ 444 55-gal drums**

The Permittee shall comply with the following conditions:

IVa.A.1. Description and Dimension of Storage Unit

Hazardous wastes shall be stored and/or non-thermally treated in containers at the indoor HWPF located on the Base Operations Center (BOC) Pad in the Western Operating Area (WOA) of the Prudhoe Bay Unit. The HWPF is a building (formerly known as the POL Building) which is a 50-foot by 60-foot structural steel frame building with insulated wall panels and a sealed concrete floor. Hazardous waste may be managed and stored throughout this building. Figure 1 provides a potential floor plan shown at the maximum storage capacity of the HWPF.

IVa.A.2. Maximum Amount and Type of Wastes

Hazardous waste stored at the HWPF at any one time shall not exceed 24,420 gallons. Hazardous waste stored at the HWPF at any one time shall not exceed 444 55-gallon drums. Types of waste to be stored at the HWPF are limited to the wastes listed in Attachment B to this Permit.

IVa.A.3. Description and Capacity of Containment System

The coated and sealed concrete floor and containment curb of the HWPF serve as the containment system for the storage area. The four-inch containment curb extends around the entire interior building perimeter and continues the floor surface coating and sealant. The floor is not sloped or designed to drain liquids to sumps or other drainage areas. The containment system has a capacity of 7,405 gallons.

IVa.A.4. Unique or Special Features

Not Applicable

IVa.A.5. Special Permit Conditions

Hazardous waste undergoing transfer into or out of the HWPF shall be managed within secondary containment to minimize the potential for a release.

IVa.B. PERMITTED AND PROHIBITED WASTE IDENTIFICATION

IVa.B.1. Permitted Waste

The Permittee may store and manage solid and/or liquid hazardous waste at the HWPF in quantities not to exceed the amounts shown in Table IVa-1, subject to the terms of this Permit.

All containers shall be labeled with appropriate U.S. EPA Hazardous Waste Codes.

IVa.B.2. Prohibited Waste

The Permittee is prohibited from managing and storing in the HWPF any hazardous waste that is not identified in Permit Condition IVa.A.2. above, with the following exceptions:

a. The Permittee is not prohibited from accepting or storing waste with certain F-list codes if those wastes are identified in Attachment B to this Permit.

b. The Permittee is not prohibited from storing wastes containing free liquids at the HWPF.

IVa.C. CONDITION OF CONTAINERS

The Permittee shall ensure that all containers are in good condition, as per 40 CFR 267.171(a).

The Permittee shall store hazardous waste only in those container types identified in Table IVa-2.

TABLE IVa-2
ACCEPTABLE STORAGE CONTAINERS

CONTAINER STORAGE AREA	ACCEPTABLE CONTAINERS BY TYPE
Hazardous Waste Process Facility	**Containers ranging in size from 1 gallon to 100-gallons that comply with U.S. Department of Transportation regulations for packaging of hazardous materials at 49 CFR § 173 and §178**

IVa.D. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittee shall ensure compatibility of the waste with the container as per 40 CFR 267.171(b).

IVa.E. MANAGEMENT OF CONTAINERS

The Permittee shall manage their wastes in containers according to the requirements in 40 CFR 267.171(c).

IVa.E.1. Storage Configuration

The Permittee shall maintain adequate aisle space as per 40 CFR 267.35. The Permittee shall not exceed:

a. A reasonable and safe stack height for containers.

b. The maximum volume of waste in storage at any time in the HWPF as listed in Table IVa-1.

IVa.E.2. Storage Container Emission Controls

All containers used to contain hazardous waste shall control air pollutant emissions from each container in accordance with 40 CFR 264 Subparts AA, BB, CC.

IVa.F. CONTAINMENT SYSTEMS

The Permittee shall construct and maintain secondary containment systems as required by 40 CFR 267.173.

IVa.G. INSPECTION SCHEDULES AND PROCEDURES

The Permittee shall, at a minimum, conduct inspections of all areas holding storage containers as required by 40 CFR 267.172.

IVa.H. SPECIAL CONTAINER PROVISIONS FOR IGNITIBLE OR REACTIVE WASTE

IVa.H.1. Location of Ignitable and Reactive Wastes

The Permittee shall not locate containers holding ignitable or reactive waste within 50 feet (15 meters) from the facility property line, as per 40 CFR 267.174.

IVa.H.2. Procedures to Prevent Ignition/Reaction

The Permittee shall take all appropriate precautions to prevent accidental ignition or reaction of ignitable or reactive waste, as per 40 CFR 267.17, and shall follow procedures specified in the site Waste Analysis Plan.

IVa.H.3. Stacking of Ignitable and Reactive Waste Containers

Containers of ignitible and reactive wastes shall be stacked no more than two high, in order to comply with the National Fire Protection Association's *Flammable and Combustible Liquids Code*.

IVa.I. SPECIAL CONTAINER PROVISIONS FOR INCOMPATIBLE WASTE

If the Permittee stores incompatible wastes in containers, the applicable requirements of 40 CFR 267.175 must be followed.

IVa.J. PREPARATION FOR CLOSURE

The Permittee shall comply with the closure requirements as per Condition III.K. and Attachment C (Closure Plan) of this Permit.

IV.b. - TANKS

Not Applicable.

IV.c. - CONTAINMENT BUILDINGS

Not Applicable.

MODULE V - SUPPLEMENTAL INFORMATION

V.A. Corrective Action

The Permittee shall comply with all terms and conditions of the BPXA RCRA 3008(h) Administrative Order on Consent (Order), EPA Docket Number RCRA-10-2007-0222, dated October 3, 2007, and any modifications to the Order. This Order is hereby incorporated by reference into this Permit.

MODULE VI - RELEASES FROM SOLID WASTE MANAGEMENT UNITS

VI.A. GENERAL DESCRIPTION

The Permittee shall institute corrective action as necessary to protect human health and the environment meeting the requirements of 40 CFR 267.101.

VI.B. RELEASES

Specific corrective action permit conditions are specified in the supplemental portion (Module V) of this standardized permit, in accordance with this Permit Condition and 40 CFR Part 264, Subpart S. [40 CFR 267.101(b)]

VI.C. SCHEDULES OF COMPLIANCE AND FINANCIAL RESPONSIBILITY

The Permittee shall demonstrate compliance with Schedules of Compliance for corrective action (where corrective action cannot be completed prior to issuance of the permit) and assurances of financial responsibility for completing corrective action as specified in the supplemental portion (Module V) of this Permit. [40 CFR 267.101(b)]

VI.D. IMPLEMENTATION BEYOND FACILITY PROPERTY BOUNDARY

The Permittee shall implement corrective action beyond the facility property boundary, where necessary to protect human health and the environment, unless the Permittee demonstrates to the satisfaction of the Director that, despite best efforts, the Permittee was unable to obtain the necessary permission to undertake such actions. In addition, the Permittee shall not be relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases shall be determined on a case-by-case basis, and shall be addressed in Module V of this Permit. The Permittee shall provide assurances of financial responsibility for corrective action of off-site releases. [40 CFR 267.101(c)]

MODULE VII - FINANCIAL REQUIREMENTS AND LIABILITY

VII.A. FINANCIAL ASSURANCE UNDER SUBPART H OF 40 CFR 267

The Permittee must comply continuously with the requirements of 40 CFR 267 Subpart H.

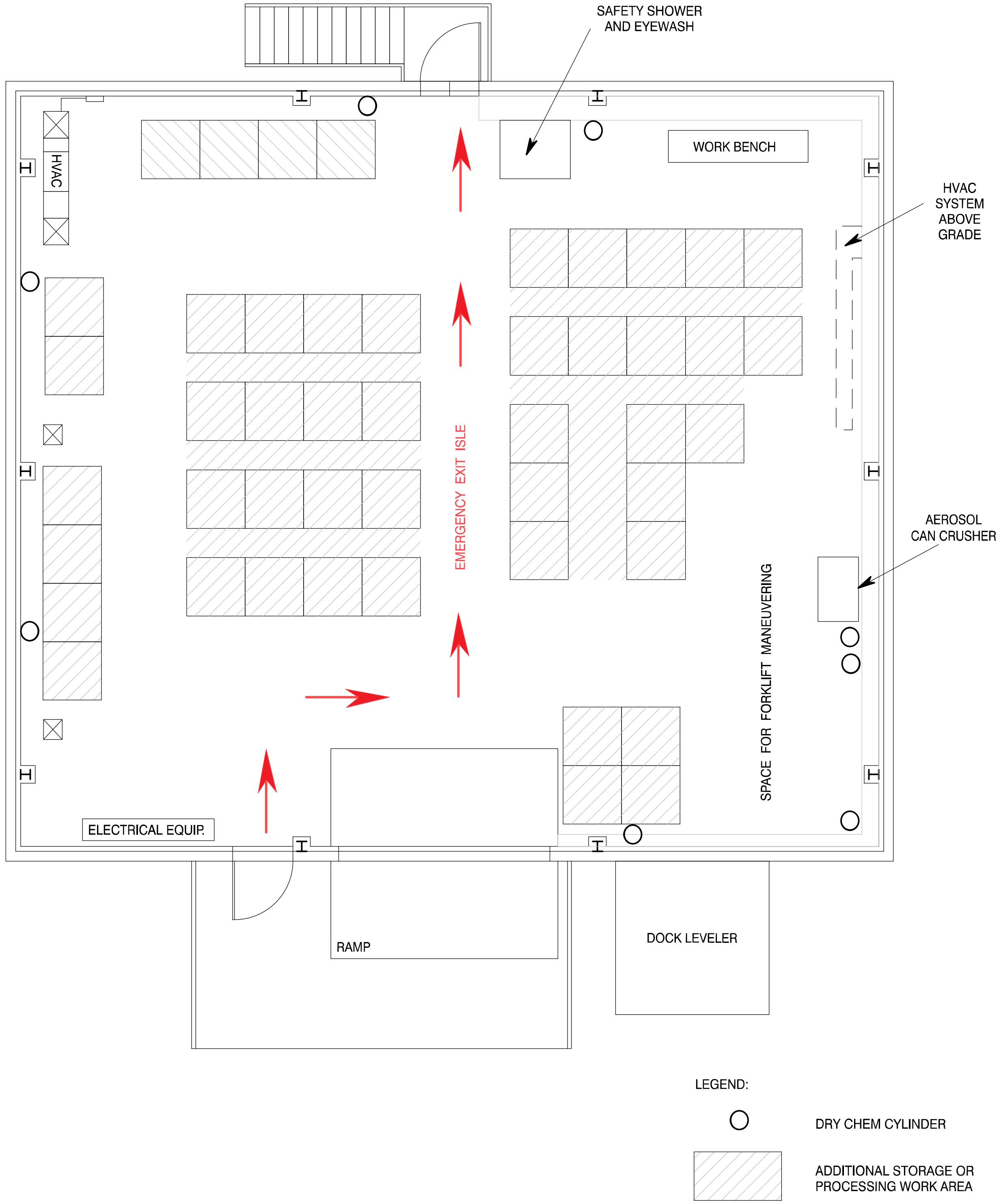
VII.B. FINANCIAL ASSURANCE FOR CORRECTIVE ACTION UNDER 40 CFR 267.101.

The Permittee shall comply with all terms and conditions of the BPXA RCRA 3008(h) Administrative Order on Consent (Order), EPA Docket Number RCRA-10-2007-0222, dated October 3, 2007, and any modifications to the Order. This condition specifically includes Section XXXVII, Financial Responsibility, and Section XXXVIII, Insurance, of the Order. The 2007 Order is incorporated by reference into this Permit as per Condition V.A. of this Permit.

FIGURE 1

Floor Plan

Hazardous Waste Process Facility



NOTES:

1. FLOOR PLAN SHOWN IS HYPOTHETICAL FOR MAXIMUM STORAGE QUANTITY ESTIMATION. STORAGE AND PROCESSING WILL BE ARRANGED WITHIN THE WORK AREA TO MEET THE FOLLOWING CONSTRAINTS.

a. MINIMUM ISLE SPACE OF 3 FEET WILL BE PROVIDED AT ALL TIMES

2. DRUMS WITHIN THE WORK AREA MAY BE DOUBLE-STACKED, EXCEPT FOR THE CLASS 1 FLAMMABLES.

3. SQUARES IN WORK AREA REPRESENT PALLETS.

4. THERE IS RACK STORAGE SPACE FOR 13 BOXES OR 52 DRUMS OF LIGHT BULBS ALONG 2 WALLS.

HILCORP NORTH SLOPE, LLC

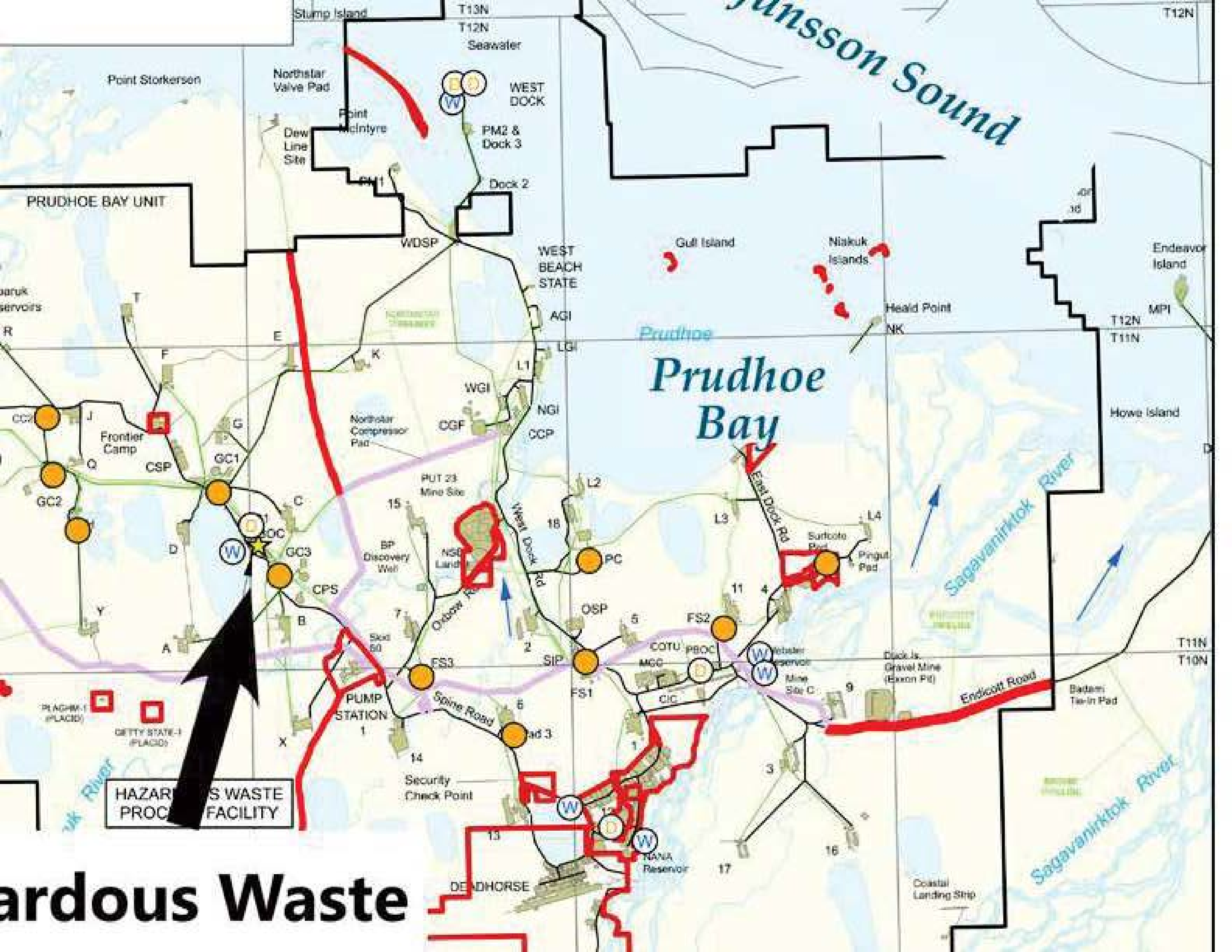
HAZARDOUS WASTE PROCESS FACILITY
FLOOR PLAN

DATE:	SCALE:	FIGURE:
December 2020	NOT TO SCALE	1 - 3

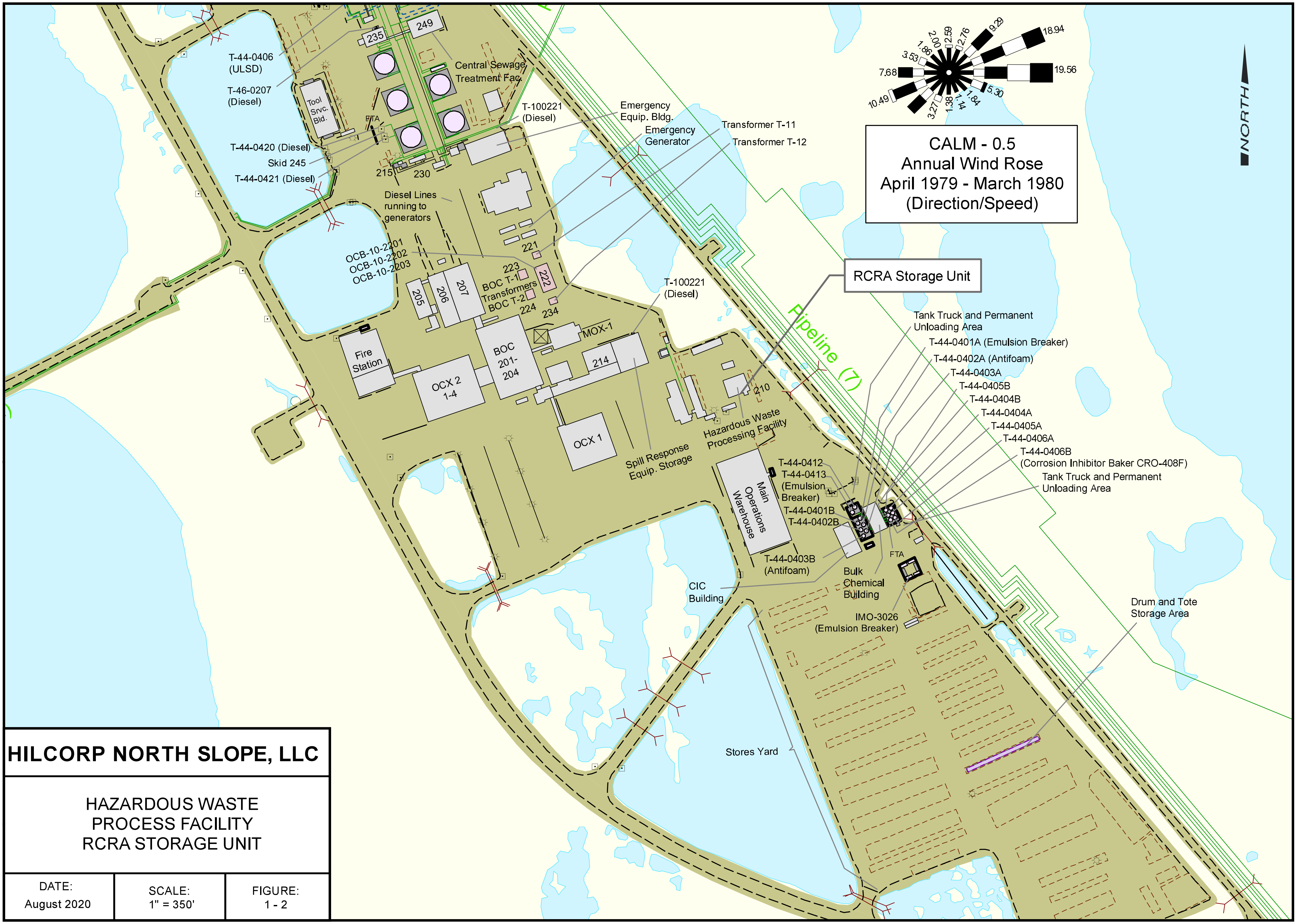
ms16895_RCRA_fig1_3.cdr

ATTACHMENT A

Locator Map and Site Maps



Gwydyr Bay
Stump Island
T13N
T12N
Seawater
Point Storkersen
Northstar Valve Pad
WEST DOCK
Point McIntyre
Dew Line Site
PM2 & Dock 3
Dock 2
PRUDHOE BAY UNIT
WDSP
WEST BEACH STATE
AGI
LGI
Gull Island
Niakuk Islands
Heald Point
NK
Endeavor Island
MPI
T12N
T11N
Prudhoe Bay
Howe Island
L1
WGI
NGI
OGF
CCP
Northstar Compressor Pad
Frontier Camp
CSP
GC1
GC2
GC3
CPS
PUT 23 Mine Site
BP Discovery Well
West Dock Rd
East Dock Rd
L2
L3
L4
PC
Surfcote Pad
Pingut Pad
Sagavanirktok River
OSP
FS1
FS2
FS3
SIP
COTU
PBOC
MCC
CIC
Mine Site C
Dock Is. Gravel Mine (Exxon Pit)
Endicott Road
Badami Tie-in Pad
T11N
T10N
PUMP STATION 1
Spine Road
Oxbow Rd
Slot 50
PLAGHM-1 (PLACID)
GETTY STATE-1 (PLACID)
HAZAR S WASTE
PROC FACILITY
Security Check Point
NANA Reservoir
DEADHORSE
Coastal Landing Strip
ardous Waste



HILCORP NORTH SLOPE, LLC

HAZARDOUS WASTE
PROCESS FACILITY
RCRA STORAGE UNIT

DATE:	SCALE:	FIGURE:
August 2020	1" = 350'	1 - 2

ATTACHMENT B

List of Allowable Waste

Attachment B

Hazardous Wastes Allowed to be Stored
Hazardous Waste Process Facility

D001 ignitable
D002 corrosive
D003 reactive
D004 Arsenic
D005 Barium
D006 Cadmium
D007 Chromium
D008 Lead
D009 Mercury
D010 Selenium
D011 Silver
D017 2,4,5-TP (Silvex)
D018 Benzene
D019 Carbon tetrachloride
D020 Chlordane
D021 Chlorobenzene
D022 Chloroform
D023 o-Cresol
D024 m-Cresol
D025 p-Cresol
D026 Cresol
D027 1,4 - Dichlorobenzene
D028 1,2 - Dichloroethane
D029 1,1 - Dichloroethylene
D030 2,4 - Dinitrotoluene
D031 Heptachlor (and its epoxide)
D032 Hexachlorobenzene
D033 Hexachlorobutadiene
D034 Hexachloroethane
D035 Methyl ethyl ketone
D036 Nitrobenzene
D037 Pentachlorophenol
D038 Pyridine
D039 Tetrachloroethylene
D040 Trichloroethylene
D041 2,4,5-Trichlorophenol
D042 2,4,6-Trichlorophenol
D043 Vinyl chloride
F001 spent halogenated solvents (degreasing)
F002 spent halogenated solvents
F003 spent nonhalogenated solvents
F004 spent nonhalogenated solvents
F005 spent nonhalogenated solvents
F027 chlorodibenzo-p-dioxins, chlorodibenzofurans, chlorophenols
F037 Benzene, benzo(a)pyrene, chrysene, lead, chromium
K050 heat exchanger bundle sludge
K052 tank bottoms (leaded)
K169 Crude oil storage tank sediment from petroleum refining operations
P001 2H-1-benzopyran-2-one,4-hydroxy-3-(3-oxo-1-phenylbutyl)-(Warfarin)
P022 Carbon disulfide
P030 Cyanides (soluble salts), NOS
P042 1,2-Benzenediol,4-[1-hydroxy-2-(methylamino) ethyl] (Epinephrine)
P081 Nitroglycerine
P088 7-Oxabicyclo [2.2.1]heptane-2,3-dicarboxylic acid
P096 Hydrogen phosphide
P098 Potassium cyanide
P105 Sodium azide
P106 Sodium cyanide
U002 Acetone
U003 Acetonitrile (I,T)
U027 Dichloroisopropyl ether
U031 1-Butanol (I)/n-Butyl alcohol (I)
U037 Chlorobenzene
U044 Chloroform
U056 Cyclohexane
U075 Dichlorodifluoromethane
U080 Methylene chloride
U112 Ethyl acetate (I)
U114 Ethylenebisdithiocarbamic acid, salts & esters
U117 Ethane, 1,1'-oxybis-
U120 Fluoranthene
U121 Methane, trichlorofluoro-
U122 Formaldehyde
U124 Furan
U126 Glycidylaldehyde
U134 Hydrogen fluoride
U136 Arsinic acid, dimethyl-
U144 Lead Acetate
U151 Mercury
U154 Methanol
U159 Methyl ethyl ketone
U161 Methyl isobutyl ketone
U165 Naphthalene
U188 Phenol
U196 Pyridine
U208 1,1,1,2-Tetrachloroethane
U210 Tetrachloroethylene
U211 Carbon tetrachloride
U213 Tetrahydrofuran (I)
U220 Toluene
U226 1,1,1-Trichloroethane
U228 Trichloroethene
U239 Xylene
U359 Ethylene glycol monoethyl ether

ATTACHMENT C

Closure Plan
Hazardous Waste Process Facility

Closure Plan

Hilcorp North Slope, LLC
Prudhoe Bay Unit
EPA ID# AKD000643239

Hazardous Waste Process Facility

Prepared By

Hilcorp North Slope, LLC
3800 Centerpoint Drive, Suite 1400
Anchorage, Alaska 99503

September 2020
Revision 1

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1 GENERAL INFORMATION

1.1 Introduction

This closure plan, including a closure cost estimate, is prepared in accordance with 40 CFR 270.275(g) and (h) requirements for an application for a Resource Conservation and Recovery Act (RCRA) Standardized Permit for Storage and Treatment Units (standardized permit) and to meet the regulatory requirements for closure summarized in 40 CFR 267, Subpart G at an existing hazardous waste management facility operated by Hilcorp North Slope (HNS). The United States Environmental Protection Agency (EPA) Facility ID number for this facility is AKD000643239. The regulated unit specifically addressed in this closure plan is the hazardous waste container storage unit (process code S01) known as the Hazardous Waste Process Facility (HWPF).

HNS is applying for renewal of its standardized permit to store and non-thermally treat hazardous wastes on-site in containers at the HWPF located within the Prudhoe Bay facility. The Prudhoe Bay facility is leased by HNS from the State of Alaska Department of Natural Resources. The Prudhoe Bay facility, by agreement of EPA, is any land or operation under HNS control within the Prudhoe Bay Unit on the North Slope of Alaska; i.e., the operating facility.

The regulated hazardous waste container storage unit that subjects the entire Prudhoe Bay facility to RCRA permitting is the HWPF. The HWPF is situated on the gravel pad containing HNS's Base Operations Center (BOC) complex, and is a 50 foot x 60 foot structural steel frame building with insulated wall panels and a sealed concrete floor founded on steel piling. Figure 1 shows the floor plan of the HWPF. The maximum permitted hazardous waste storage capacity of the HWPF is 444 (55 gallon) drums.

BPXA submitted a revised Part B permit application in June 1998 to provide Part B permit application information of the HWPF as-built and to update the Part B permit application initially submitted on November 8, 1988. EPA authorized a change under interim status in the year 2000 to allow BPXA to begin storing hazardous waste generated on-site in the HWPF for greater than 90 days. HNS began operating the HWPF July 1st, 2020.

HNS has prepared a Notice of Intent (NOI) and application for renewal of its RCRA standardized permit under the provisions of 40 CFR 267. This closure plan for the HWPF is submitted as part of that standardized permit application.

1.2 Facility Description

The Prudhoe Bay facility is a contiguous land area of approximately 397 square miles. Security gate checkpoints limit access to the oil field, and only persons authorized access are permitted through the checkpoints.

The PBU generates wastes related to oil and gas production operations and support facilities. Operations include, but are not limited to, oil and gas production wells, water and gas injection wells, operations centers, several flow stations/gathering centers, a central compressor plant, a central power plant, a seawater treatment plant, a seawater injection plant, a grind and inject facility, and a crude oil topping unit. Support facilities include vehicle maintenance shops, laboratories, paint shops, offices, warehouses, living quarters, dining facilities, pipelines, and electrical power transmission lines. Wastes accepted at the HWPF have predominantly been hazardous wastes generated by HNS within the Prudhoe Bay facility boundary. As described in the 1998 RCRA Part B permit application, wastes had occasionally been accepted from outside the boundary on a case-by-case basis (e.g., from BPXA oil exploration projects and seismic operations). This standardized permit application has been prepared in accordance with 40 CFR 270.255(a)(1) to store or non-thermally treat hazardous waste.

1.3 Facility History

Hazardous waste management activities were initiated at the HWPF in 2000, and are expected to continue for many years. The HWPF is the only hazardous waste management facility within the PBU. The volume and types of wastes managed at the HWPF are dependent upon the ongoing oil and gas exploration and production activities performed within the PBU per anum. Many of the same waste streams are generated year-after-year, while others are generated intermittently. The volume and type of hazardous waste generate and disposed of are described in the associated PBU biennial reports.

The historical record between 2000 and 2021 for the PBU indicates there has only been one container received at the facility with a small leak resulting cleanup of residual materials. While additional spills and releases are possible, they are unlikely to occur. The facility is maintained in a neat and orderly condition and all containers of liquid wastes are placed on or within secondary containment measures upon receipt and located on top of the sealed concrete floor present within the HWPF. The HWPF is inspected routinely. Weekly inspections have been performed and documented by BPXA/HNS personnel since it became operational, and biennial insections are performed and documented by EPA RCRA enforcement representatives. These inspections include a review of waste storage, secondary containment measures, any potential spills or releases, and the condition of the building floor (including the integrity of the protective surface sealant and cracks in the concrete).

The historical record for the PBU indicates only limited quantities of polychlorinated biphenyl (PCB) containing wastes have been managed during the operational history of the PBU from 1969 to present. A thorough review of PCB use and waste generation within the PBU was performed during identification of Constituents of Potential Concern (COPCs) during initiation of corrective action as part of the facility-wide 3008(h) RCRA Compliance Order by Consent (RCRA-10-2007-0222). The results of this review are documented in the *Regulated Constituents of Potential Concern Report, Prudhoe Bay Alaska, Administrative Order on Consent, RCRA-10-2007-0222 (ERM 2016).*

Historical operational data indicate PCBs were used within the PBU, but were not present at concentrations that required regulation, or as a significant component in materials stored, used, or spilled within the PBU. Periodic testing for PCBs has been performed in areas of the Prudhoe Bay facility where they were most likely to be detected with results for all samples reported as non-detect. PCB testing has primarily been performed at various exploration site reserve pits, and to support project-specific waste characterization (including ongoing RCRA Facility Investigations). HNS and its predecessor BP Exploration (Alaska) Inc. (BPXA) did not have knowledge or suspicion that would warrant inclusion of PCBs as RCRA Order COPCs resulting from: (1) the limited use and disposal of PCB-containing oils or oil-filled transformers; and (2) the absence of any reported oil-filled transformer spills or releases.

Transformer oils present within the PBU were tested for PCBs and PCB containing materials were managed in the 1980s with the promulgation of applicable Toxic Substance Control Act regulations. Very limited volumes of PCB containing transformer oils were removed and transported off-site for disposal at that time. Since operations began at the current the HPWF in 2000, no PCB-containing transformers or transformer oils have been managed at this facility. The primary PCB-related wastes materials managed at the HWPF are fluorescent light ballasts and electronic capacitors. The presence of PCBs in these light ballasts and capacitors is not confirmed prior to off-site disposal and it's likely PCBs are not actually present. These wastes are managed in one location within the HWPF, as shown on Figure 1. The total mass of potential PCB containing wastes managed since 2000 at the HWPF is 31,104 pounds.

1.4 Regional Features

The Prudhoe Bay facility is located on the North Slope of Alaska, approximately 250 miles north of the Arctic Circle and 175 miles west of the Alaska-Canada border, in the Arctic Coastal Plain region. The Prudhoe Bay facility is approximately 397 square miles in size and is comprised of the Eastern Operating Area (EOA) and Western Operating Area (WOA). Several discreet areas within the Prudhoe Bay facility boundary are excluded from the RCRA operating facility. These include individual Deadhorse lease tracts, the Deadhorse airport, the North Slope Borough's Oxbow Landfill, specific gravel quarries, select exploration drilling sites, facilities owned and operated by oil industry support contractors such as Frontier Pad, Service City Pad, select pipeline corridors to non-Prudhoe Bay Unit facilities, and the Trans-Alaska Pipeline corridor.

The Prudhoe Bay facility occupies a region of low relief covered by numerous shallow lakes and drained lake basins. The mean annual precipitation (rain and snow) is less than 10 inches. Practical sources of groundwater do not exist in this region due to the presence of permafrost. Permafrost begins a few feet below the surface and extends to depths of 2,000 feet. The presence of permafrost also affects surface water features. Oriented thaw lakes cover over half the land surface of the region. These lakes form when permafrost prevents infiltration. The lack of topographic variation causes drainage patterns to be poorly defined, but surface streams and rivers generally flow north toward the Beaufort Sea.

1.5 Plan Objectives [Closure Performance Standard – 40 CFR 267.111]

This closure plan was prepared to be consistent with RCRA requirements for the "clean closure" of a hazardous waste container storage unit in the regulations; specifically, 40 CFR 267.111 - 267.115, and 267.176.

This closure plan describes the measures to be taken by HNS to minimize the need for further maintenance of the HWPF and to control, minimize, and eliminate, to the extent necessary to protect human health and the environment, the post-closure potential for releases or escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.

For purposes of this Closure Plan, which is for a future closure of the HWPF, Human Health action level concentrations are presented for closure performance standards. Table 1 presents the U. S. EPA-approved lowest Tier II Action Levels that are described in the Revised Site-Wide Conceptual Site Model and Screening Level Report, Prudhoe Bay Facility (SLR, April 2016) *Part III of the Site-Wide Project Work Plan, BPXA Administrative Order on Consent under Section 3008(h) of the Resource Conservation and Recovery Act (RCRA), BPXA's Prudhoe Bay Facility, Environmental Protection Agency ID No. AKD000643239, U.S. EPA Docket No. RCRA-10-2007-0222, October 3, 2007* (Order), and updated most recently in the *2019 RCRA Annual Report*, *Prudhoe Bay Facility, Alaska, Administrative Order on Concent RCRA-10-2007-0222*. Since the Tier II Action Levels are updated periodically based on changes to EPA Regional Screening Levels and changes in ADEC Cleanup Levels specified in 18 AAC 75 Contaminated Sites Program regulations, the most recent EPA-approved Tier II Action Levels will be used as performance standards during future HWPF closure.

The Tier II Action Levels represent conservative risk-based performance standards for use in identifying COPCs for remedial investigations that are conducted under the Order. The Tier II Action Levels are calculated, risk-based concentrations, protective of human and ecological receptors specific to the North Slope and use some site-specifc factors. Although ecological action levels are presented in the table they are not considered relevant to the decontamination of interior surfaces.

In addition to the levels presented in Table 1, closure performance standards for polychlorinated biphenyls (PCBs) will also be considered at the time of closure. For purposes of this closure plan, a screening concentration of 10 micrograms PCBs per 100 square centimeters of applicable surfaces within the HWPF is presented for wipe samples; this concentration represents a conservative value for indoor unrestricted surfaces and is consistent with EPA policy in 40 CFR Part 761 Subpart G. A concentration of 1.0 milligram per kilogram (mg/kg) will be applied to bulk concrete samples.

The closure plan includes procedures that will be used during the closure process to remove all hazardous waste and to decontaminate or remove hazardous waste residues, if any, from the HWPF so the closure performance standard is met. Once the HWPF has an EPA-approved closure plan, the closure plan is implemented, closure is certified by an independent, registered professional engineer, and EPA accepts the closure, it will no longer be designated as a hazardous waste management regulated unit and will be released to HNS for other uses without any land use restrictions or institutional controls.

This plan also contains provisions for amending the closure plan, presents a schedule for closing the facility (at the time of closure), and provides an estimate of closure costs.

Until final closure of the facility is completed and certified, copies of the closure plan and approved revisions to the approved closure plan will be maintained at the following locations, in addition to being accessible within HNS's electronic file system:

Hazardous Waste Process Facility Office
HNS Base Operations Center
HNS Prudhoe Bay Western Operating Area
Prudhoe Bay
North Slope Borough, Alaska

HNS Environmental Department
Hilcorp North Slope, LLC
3800 Centerpoint Drive, Suite 1400
Anchorage, Alaska 99503

2 PARTIAL CLOSURE OF FACILITY [40 CFR 267.112]

Partial closure of the RCRA facility is not planned since this is the only designated hazardous waste storage unit at the Prudhoe Bay facility. Two former hazardous waste container storage units located within the Prudhoe Bay facility have been closed. One was at C Pad in WOA (closure certificate dated August 17, 2004) and the other was at C Pad in EOA (closure certificate dated May 13, 2005). EPA accepted the two Certificates of Closure in correspondence dated February 27, 2007 and released BPXA from financial assurance specific to closure of the WOA C-Pad and EOA C-Pad in correspondence dated March 5, 2007. This closure plan does not address either of those two former RCRA units or corrective action at any solid waste management units within the Prudhoe Bay facility.

3 FINAL CLOSURE OF FACILITY

3.1 Site Description

The HWPF is the only permitted waste management facility at the Prudhoe Bay facility. Hazardous waste may be stored or retained at the HWPF for non-thermal treatment for >90 days. The HWPF is designed to handle containerized wastes only; it does not include any hazardous waste tank systems, nor is it a Subpart DD Containment Building. The Handling Code (for Treatment, Storage and Disposal Methods, see 40 CFR 265 Appendix I, Table 2) for the HWPF is exclusively S01. Flammable and corrosive wastes are stored separately within the HWPF, predominantly in hazardous materials cabinets which have built-in secondary containment.

3.2 Maximum Inventory of Wastes [40 CFR 267.112(b)(3)]

The maximum inventory of wastes is the design capacity of the HWPF. The HWPF's maximum inventory is 444 drums. Based on the recent historical wastes generation within the PBU, the following breakdown of wastes is anticipated when the facility is at maximum capacity:

Flammable and Off-Specification Oil (no halogenated compounds)	262 drums
Chlorinated solvent/Waste Oil	40 drums
Aqueous Acid/Base with RCRA metal	56 drums
Lab Packs and RCRA Medical Waste	20 drums
Mercury-Containing Waste	10 drums
Lamps/Light Bulbs (containing lead and mercury)	52 drums
Light Balasts and Electrical Capacitors (potentially containing PCBs)	4 drums

This closure plan uses the maximum drum inventory and waste subcategory breakdown described above as merely a basis for estimating a closure cost. HNS generates and stores a wide variety of hazardous waste, as indicated in the material receipt logs, in the RCRA Biennial Reports, and in Part A information included in the standardized permit application. Waste types and amounts also vary in conjunction with the types of projects, activities and waste minimization practices that are implemented throughout the Prudhoe Bay facility. This breakdown may be more accurately and precisely revised within 45 days of HNS's written notification of final closure submitted under 40 CFR 267.112(d).

3.3 Closure Procedures [40 CFR 267.111]

When the HWPF is to be closed, the activities described below will be performed to achieve final closure. An updated project-specific HNS Health and Safety Plan will also be followed for onsite closure activities.

3.3.1 Notification [40 CFR 267.112(d)(1)]

Regulatory agencies will be sent HNS's written notification of final closure at least 45 days before HNS expects to begin closure and the closure activities herein are initiated. Written notification of the intent to close the facility will be sent to EPA Region 10, the Alaska Department of Natural Resources and the Alaska Department of Environmental Conservation.

3.3.2 Inventory Removal [40 CFR 267.112(d)(2), .115(a), and .176]

After the notification to close the facility has been filed, no additional hazardous waste, non-hazardous waste, or hazardous materials will be accepted for storage at the facility. Closure will begin no later than 30 days after the final known volume of waste is accepted at the HWPF. Wastes present in the HWPF at the time of the final waste acceptance cut-off date will be inventoried and prepared for offsite shipment through waste disposal contractors that are under contract to HNS at the time of closure.

Hazardous wastes that are on site at that time will be removed consistent with procedures followed during the active life of the unit. Wastes will be characterized for off-site disposal according to procedures outlined in HNS's HWPF Waste Analysis Plan (WAP) and in accordance with waste analysis requirements in 40 CFR 267.13 and 40 CFR 268. It is anticipated that sampling of wastes in containers at the time of closure will be routine and minimal, as existing waste profiles will primarily be used for disposal. However, for purposes of the closure cost estimate and the requirement to use a worst-case estimate, it is assumed that the HWPF would have its maximum inventory (i.e., 444 drums of waste) and that half of the drums will require sampling and profiling. Disposable bailers will be used to sample drums to avoid cross-contamination and reduce decontamination-generated waste. Sampling procedures are described in the Sampling and Analysis section below, as well as the summary in Table 1.

All stored hazardous wastes will be removed within 90 days from the day that the last waste was accepted at the HWPF.

3.3.3 Decontamination [40 CFR 267.112(b)(4), .116, and .176]

Following removal of all containers of hazardous waste, universal waste, and non-hazardous solid waste, decontamination of equipment and the inside surfaces of the HWPF building will be performed by appropriately trained personnel. Any equipment that had been used in handling hazardous waste at the facility and that will not be disposed will be decontaminated. Such equipment and all areas of the facility, including storage areas, floors, and building walls will be decontaminated to the levels required by EPA Region 10 at the time of facility closure; i.e., closure performance standards.

The decontamination procedure will include, but not be limited to, the following activities for each type of equipment or surface.

Decontaminate Process Equipment:

Any hoses that have been in contact with hazardous waste and/or hazardous material will be placed in a container and characterized for offsite disposal.

A decontamination station will be established in an area convenient for performing the equipment decontamination activities and associated wastewater collection.

Equipment that had come in contact with hazardous waste and/or hazardous materials will be decontaminated, including the cabinets and secondary containment pallets used to store drummed waste.

Decontamination will be accomplished by manually scrubbing, washing, or spraying equipment with detergent solutions and/or steam or high pressure water.

Decontaminated equipment will be rinsed with tap water until all detergent and other residue is washed away. The rinsing can be completed with a squeeze bottle and/or pressure washer, depending on the equipment being decontaminated.

All spraying and steam cleaning will be conducted to minimize overspray and minimize the potential to spread waste constituents. Temporary berms may be installed to isolate and collect rinsate within areas of the building. All spent decontamination wash fluids and rinsate will be collected and containerized.

Equipment that has been decontaminated will be allowed to air dry in a clean area.

Any equipment used in the decontamination procedures (e.g., brushes, vacuum) will subsequently be either properly disposed or decontaminated by rinsing, flushing or steam cleaning. Steam cleaning will be conducted in a manner to minimize overspray, to keep from spreading the waste.

Equipment that can not be decontaminated by rinsing or steam cleaning to the acceptable closure performance standard will be managed and disposed in accordance with applicable waste characterization and disposal requirements at the time of closure.

All wastewater generated by decontamination activities will be collected in drums labeled as decontaminate rinsate. Such wastewater from various decontamination activities will be consolidated.

Decontaminate Process Area Floors, Building Walls, and Ceilings

The building floor, interior walls and ceiling will be decontaminated after all decontaminated equipment and materials are removed from the building.

The facility interior operating area will be swept free of dirt and debris.

Ceilings will not be cleaned unless a spill occurred that could have contaminated the ceiling or if stained areas are visually observable.

The following types of areas will be scrubbed and wipe cleaned in a focused manner with water and an ionic surfactant: any areas of visible staining, any known spill sites, and areas that for other reasons there is a concern of residual chemical contamination.

The floor and interior walls of the HWPF will be decontaminated by high pressure rinsing with hot water or steam and an anionic surfactant. Rinsing will be started at the highest point, with work progressing down towards the floor. To minimize the chance of spreading any potential contaminants, rinsing will be aimed away from areas that have already been decontaminated. Temporary berms may be installed to isolate and contain rinsate within areas of the building. Careful consideration will be made to not recontaminate already decontaminated areas.

The rinsate will be vacuumed out until the area is dry and containerized for sampling and disposal.

The HWPF does not have any trenching, drains, or sumps that would require additional attention during decontamination.

Confirmation Sampling

Confirmation sampling will be performed after decontamination activities. Wipe samples will be collected to monitor non-volatile analytes (e.g., semi-volatile organics and metals) on smooth, non-porous surfaces (e.g., metal). Bulk concrete sampling will be collected to determine semi-volatile organics, PCB and metals concentrations in the floor. The purpose of the confirmation sampling is to confirm that either:

- Equipment, structures, and buildings are not contaminated; or
- Contaminated equipment, structures, and buildings have been properly decontaminated.

A multi-tiered sampling approach will be used for determining the sample locations, based on the building conditions and known releases at closure. Three sample options are described here: PCB Storage Area, No/Limited Release, and Multiple Release alternatives. Visual Sample Plan (VSP) software has been used to determine the initial random or systematic grid sample locations. Judgemental samples have been included to focus on areas of concern (stained areas, cracks in concrete floor, historic release locations, etc.). The sample locations may be adapted as needed when judgmental sample locations are added. Examples of the VSP sampling designs for the walls and concrete floor are included to document the sampling approach selected.

For the PCB Storage Area sample plan design, a corner area where PCB waste is stored, was used with VSP. A systematic grid approach will be used to collect six wipe samples and six concrete samples from the selected area. Up to two wipe samples and two concrete samples may be collected from judgemental sample locations. These samples would be analyzed for PCBs only unless evidence or knowledge suggests that other potential constituents of concern have been managed in this area.

The No/Limited Release option for verification sample collection will be conducted using a combination of a simple random sampling approach for the determination of sample locations and a judgmental approach to include known or likely areas of contamination as determined by the HWPF operating record at the time of closure.

For the No/Limited Release option, wipe samples will be collected for metals, PCB, and SVOC analysis at nine random wall locations within the building. Additional judgemental sampling locations will be selected from any apparent areas with visible staining prior to decontamination, any known spill areas, and any other identified potential areas of concern. Up four additional wipe samples will be collected from judgemental wall locations If no potential areas of concern are identified from facility records or visual observation, then samples will be collected from the following locations:

- Area of wall approximately 1 foot from the floor near waste consolidation area
- An area of wall approximately 3 feet from the floor near waste consolidation area

For the No/Limited Release option, bulk concrete samples will be collected for metals, PCB, and SVOC analysis at nine random locations from the building floor. Additional judgemental sampling locations will be selected from areas that had contained visible staining prior to decontamination, any known spill areas, and any other identified potential areas of concern. Up to three additional concrete samples will be collected from judgemental floor locations. If no potential areas of concern are identified from facility records or visual observation, then samples will be collected from the following locations:

- Floor under two areas where waste containers were stored
- Floor under two areas where wastes were consolidated
- At least three wall paint chip samples will be collected for PCB analysis

In the event of multiple future releases or large future releases at the HWPF, a Multiple-Releases sample approach will be used. The Multiple-Releases sampling approach doubles the sample density proposed for the No/Limited Release sampling approach. Eighteen wipe samples and 18 concrete samples will be collected using a random approach from the building walls and floor. Up to 8 additional wipe samples and 6 additional concrete samples would be collected from judgemental locations of known or suspected contamination. At least three wall chip paint samples will be collected for PBC analysis.

Sample locations will be documented in writing on appropriately scaled building diagrams and with photographs. Additionally, two background wipe samples will be collected from interior doors or walls (selecting smooth and non-porous surfaces) at two locations inside the neighboring BOC living quarters area. Background samples will be collected from an unoccupied sleeping quarters and a television lounge, both areas that would not be expected to have or have had industrial activities or contaminations. Two background bulk concrete composite samples will also be collected from clean floor areas within the HWPF or neighboring BOC living quarters.

In order to focus decontamination activities within the HWPF to any identified areas of concern, sampling and analysis will be performed in a tiered approach, starting with decontaminated surfaces. If contamination is detected in wall wipe samples, or reported at concentrations above closure performance standards is detected in the post-decontamination concrete and gravel samples, then decontamination of those surfaces will be repeated, as described above. If closure performance standards are met after the subsequent decontamination, no additional sampling will be performed. If contamination is still redetected at levels above closure performance standards after the second decontamination, then the closure plan will be modified to address potential contaminants impacts to the floor, ramp/loading dock, or gravel or outside the building. Additional sampling and analysis of the concrete floor and the gravel pad would be performed and, depending on analytical results, removal of concrete or gravel pad material may be completed in order to achieve clean closure.

Wall Wipe Sampling

Confirmation wall wipe sampling will be conducted using the following general guidelines, which will be adjusted at the time of closure in accordance with the selected laboratory's requirements for sample amounts and preservation:

- A template will be used to provide a fixed area for collecting wipe samples. The template will be constructed from a solid flat sheet of Teflon or an inert plastic, such as PVC or polyethylene, with a square opening of 10 centimeters by 10 centimeters.
- The sample media (i.e. filter paper or cotton gauze) will be placed in a clean sample bottle (2 to 4 oz. glass bottle with Teflon-lined cap), to which a controlled volume of solvent is added by the laboratory performing the analyses. The amount of solvent used per sample bottle will be consistent throughout the wipe sampling program and should be sufficient to saturate the sampling media with little or no excess left in the bottle.
- The solvent applicable to the species of analytes will be used, depending on the surface being sampled and the target analyte. The specific solvents will be described in revisions to this closure plan, at the time of closure, depending on the final selected list of target analytes. For purposes of this closure plan, total semivolatile organics will be sampled with methanol premoistened gauze pads, PCBs will be sampled with gauze pad premoistened with hexane, and metals will be sampled with "Ghost Wipes" premoistened with deionized water.

- Gloved hands or forceps will be used to handle the sampling media, including taking the clean sampling media from its packaging and placing it into the sample container.
- Forceps will be stored in Ziploc bags between uses and decontaminated between samples. Alternatively, disposable forceps may be used to reduce cross contamination.
- Disposable templates will be used to avoid potential cross contamination.
- The sampler will approach each sample location with a wipe sample template, a prepared sample container, and the required gloves and other needed personal protection equipment.
- The prepared sampling media will be removed from the sample bottle manually and folded in half or in quarters. Sufficient solvent should be present to premoisten the wipe; excess solvent should not be present.
- The wipe sample template will be held firmly against the surface to be sampled with one gloved hand. Sufficient pressure should be maintained throughout the sampling process.
- With the sampling media in the other gloved hand, systematically and thoroughly wipe in one direction (e.g., left to right) using S-strokes covering the entire surface from edge to edge.
- While continuing to hold the template in the same location, refold the sampling media to expose unused surface and re-wiped the sampling location thoroughly using single strokes covering the entire surface from edge to edge again, this time at right angles to the first wipe (e.g., top to bottom).
- The sample media will then be placed into the sample container and the cap secured.
- Remove and discard gloves before handling the next the sampling media or container and between sampling locations.
- The sample container will then be managed as described in the Sample Handling section below.
- Sampling points will be marked with a tape measure from corners of the building, with sample coordinates recorded in the field notebook

Wipe sampling for semivolatile organics, PCBs and metal will occur in separate and distinct locations following the steps outlined above. Samples will be analyzed as described in the Sampling and Analysis section below.

Field/Gauze Blanks – A blank will be analyzed for each analytical parameter using an unopened gauze pad shipped to the field and returned to the laboratory. This blank will serve to demonstrate cleanliness of the wipes used to conduct sampling. One gauze of each type will be analyzed with the 12 samples and two background samples collected.

Duplicates – One duplicate will be collected for each parameter collected for analysis. Although these samples are not true duplicates, they should be collected side-by-side or below the original sample location. This data can be used to determine potential differences in contamination of surface areas.

If waste-related contaminants of concern are detected in the wipe samples, and not detected in the blank samples, the interior walls will be decontaminated a second time, followed by collection of a second set of wipe samples and field quality control samples.

Concrete and gravel sample results will be compared with the performance standards in Table 1.

Facility Floor and Gravel Pad Materials Sampling

To date, there have been no PCB or hazardous waste releases inside or in the immediate vicinity of the HWPF that would impact the surface or subsurface gravel surrounding the building, and there is no observed staining on the gravel pad surface around the building. There are no visible surface cracks, breaches, or scouring in the HWPF floor coating that would indicate the integrity of the surface coating has been compromised. Inspections of the floor and the loading areas where hazardous wastes are transferred in and out of the building are routinely conducted and documented by trained personnel. Therefore, migration of hazardous wastes or hazardous waste constituents has not occurred.

If, at the time of closure, a review of release records indicates that no hazardous waste releases have been reported in the immediate vicinity of the HWPF and if no stained areas are observed (from hazardous waste transfer operations in and out of the building, as no outside storage of hazardous waste will be conducted), additional sampling of the gravel pad surrounding the building and gravel removal actions would not be performed and the No/Limited Release option will be followed to confirm facility decontamination is adequate.

For the PCB waste storage area within the HWPF (Figure 1), six systematic grid concrete floor samples, and up to two judgemental samples will be collected for analysis of PCBs. Sample collection details are defined in the VSP sampling summaries provided in Attachment 1. PCB floor sampling will be performed independently of the No/Limited Release option or Multi-Release option sampling. Concrete sample collection will be performed in accordance with the May 2011 *Standard Operating Procedure for Sampling Porous Surfaces for Polychlorinated Biphenyls.*

For the No/Limited-Release option, a systematic grid approach will be used to collect a minimum of nine concrete samples from the floor inside the HWPF. Concrete samples will be analyzed for metals and semivolatile organic compounds. A total of 9 systematic grid concrete or gravel samples will be collected from the ramp and loading dock area at the main HWPF entrance. Concrete and gravel samples will be analyzed for metals and semivolatile organic compounds. Gravel samples will also be analyzed for volatile organic compounds. The VSP systematic approach for the ramp and loading dock area is included in Attachment 1.

For the Multiple-Releases option, the systematic grid approach would be used to collect 18 random and 8 judgemental concrete floor samples. A total of18 additional systematic concrete and gravel samples will be collected from the ramp and loading dock area and up to 6 judgemental samples will be collected from external surface gravel amples surrounding the building in areas of known or suspected releases. These sampling approaches are detailed in the VSP outputs provided in Attachment 1.

This closure plan does not include removal of gravel pad material surrounding or under the HWPF. If releases of hazardous wastes or hazardous waste constituents are reported in the vicinity of the HWPF due to HWPF loading and unloading operations, the closure plan will be revised accordingly.

Management of Decontamination Wastes

All rinsate will be collected using a water-safe vacuum and collected and stored in compatible shipping containers. A composite sample of the rinsate will be collected.

If analytical results indicate that the rinsate is hazardous waste, it will be evaluated for potential de-characterization (for fluids that only exhibit hazardous waste characteristics for ignitability, corrosivity, reactivity and toxicity) and disposal at a permitted HNS Underground Injection Control (UIC) Class I non-hazardous injection well, in accordance with 40 CFR 268.1(c)(3) and 40 CFR 148.1(d). Alternately, if de-characterization is not feasible, the rinsate will be labeled, manifested, and disposed of at an appropriately permitted off-site treatment, storage or disposal facility (TSDF). If analytical results indicate that the rinsate is non-hazardous waste it will be disposed at a permitted HNS UIC Class I non-hazardous injection well.

Solid residuals from the decontamination process (e.g., used rags, personal protective equipment, and other disposable equipment) will be collected, analyzed, and characterized for appropriate off-site disposal.

3.3.4. Sample Handling

Sample Numbering - The field sample identification code provides the tracing of the sample from the location in the field, through laboratory analysis, and finally to data presentation.

Each sample will be assigned a unique field sample identification code and labeled accordingly. This field sample identification code will contain information traceable to the site, location, and other appropriate information unique to that sample. This code will be used for all references to this particular sample in all field and project documentation and reports.

All field quality control samples will be labeled and numbered so that the laboratory cannot distinguish them from other site samples.

Sample Labeling and Documentation - Individual sample labels will be affixed to the sample containers. Waterproof indelible ink will be used to ensure the integrity of the sample identification code. The following information will be included on each sample label for samples submitted for laboratory analysis:

- Project site
- Project number
- Sample collector name and initials

- Date and time of collection
- Field sample identification codes
- Analyses requested
- Preservation

Sample Storage, Transport, and Chain of Custody - Following sample collection and labeling, samples will be packaged for transport to the analytical laboratory. Samples will be stored in a cooler with ice or gel ice packs, and shipped to the laboratory for sample analysis within method-prescribed holding times. The following shipping procedures will be used:

- Each sample container will be placed in a resealable plastic bag and wrapped in bubble pack or another inert material to prevent breakage prior to placement in a cooler.
- Ice will be placed in the coolers to keep samples at a temperature of 4°C +/-2°C.
- Prior to shipping, the signed and dated chain-of-custody forms will be placed in a sealed bag that is then taped inside the cooler lid.
- Custody seals will be placed on the front right and back corners of each cooler. Seals will be covered with clear tape.
- "This Side Up" labels will be placed on four sides of the cooler and "Fragile" labels will be placed on two sides. All drains will be taped shut.

Chain-of-custody procedures will be followed in accordance with standard EPA protocol in order to track the custody of the samples. The chain-of-custody form is designed to document the transfer of samples from the field to the laboratory. As such, the form summarizes the contents of the shipment and tracks the dates and times of any custody transfer, and signatures of all parties relinquishing and receiving the samples. The sampler must sign the chain-of-custody form(s) in the designated "sampler" space and the "relinquished by" space. A copy of the form is taken before the cooler is sealed, and the original form is placed in the sealed plastic bag and sealed inside the cooler. If temporary storage of the cooler is needed prior to shipment, it will be stored in a secured location.

When completed, this form will contain the following information:

- Sample numbers (corresponding to the sample ID numbers on the sample labels)
- Project number
- Project/client name and location
- Sampler's signature
- Custody seal number
- Date/time of sample collection
- Type of samples (e.g., wipe, liquid, solid)
- Analytical requirements
- Number and type of containers
- Remarks (e.g., wipe sample surface area)
- Date/time samples relinquished
- Date/time samples received

From the time the sample is collected, it will be under the direct control of the contracted field team. If a sample cooler is left unattended, it must be secured with a custody seal and signed by the responsible party. The custody seal will have an identification number on it, which will be recorded on the chain-of-custody form. Copies of the chain-of-custody forms will be returned by the laboratory with the analytical results. The form will indicate personal custody of the sample by dated signature and the analytical suite for each sample.

3.3.5 Field Records

Field records will be maintained to demonstrate that closure activities are conducted in a manner that is consistent with the approved closure plan and to document approved deviations from the closure plan, if necessary. Field records for the closure of the HWPF will be compiled in bound field notebooks or logbooks. The field notebooks will have consecutively numbered pages and documentation will be recorded using waterproof ink. Incomplete lines, incomplete and blank pages, and changes in the notebooks will be lined out with a single line, dated and initialed (no obliteration of an incorrect entry or use of correction tape or fluid). The information that will be recorded in the notebooks will include, at a minimum:

- The responsible person's name
- The date and time of the activities
- References to field monitoring forms as necessary
- Daily field instrument calibration information, including the calibrator's name; the
- Instrument name and model; date and time of calibration; standard lot numbers used and their source; ambient temperature (if needed); results of calibration; and any corrective actions necessary
- Weather conditions, if applicable
- Topics and attendees of daily tailgate meetings
- Activities that are scheduled for the day, including a notation as to whether they have been completed on that day
- Approved deviations to the closure plan and rationale for deviations
- Name of personnel onsite and their representative companies
- Decontamination information
- Sampling information, including information coordinating sample handling activities with the appropriate field activities and chain-of-custody documentation; equipment and methods used for field preparation of samples; field measurements for samples, if applicable, drawings and diagrams of sample locations
- Waste shipment information
- Unusual site or schedule conditions, including issues that delay closure activities
- Communications to and from oversight HNS representatives and EPA or other appropriate regulatory agencies
- Project comments

Photographs may be taken to photodocument certain activities when necessary and appropriate. Printed copies of the photographs will be initialed by the person who took the photo and dated when the photo as taken (unless the photo is imprinted with the date taken). A Photo-Log or other listing of the photographs that were taken will be completed as the photographs are taken to record the identity of the photographer(s), date, time, location and a brief description of the photo, including anything of special note. Photographs taken of closure activities and the Photo-Log will be maintained as part of the HWPF closure field records.

3.5 Sampling and Analysis (40 CFR 267.112(b)(4) and .176)

This section describes the sampling and analysis that will be performed, with summaries provided in Table 1 - Samples and Table 2 - Analytical Methods.

The following types of samples are included in this closure plan and will be collected during HWPF closure:

- Contents of containers of hazardous waste on-site at the time of final inventory removal, as needed for complete waste characterization
- Surface wipe samples of interior surfaces from inside the BOC living quarters to determine background levels of potential contaminants of concern
- Surface wipe samples of decontaminated equipment and structures inside the HWPF, for confirmation of decontamination
- Rinsate resulting from the decontamination operations, for waste characterization
- Solid waste resulting from decontamination, for waste characterization

Samples collected during the closure activities will be analyzed for the constituents of the wastes managed at the facility. The sampling of waste containers during the building de-inventory will follow guidance in the most current version of the HNS controlled document procedure, *Hazardous Waste Process Facility Waste Analysis Plan (#UPS-US-AK-GPB-ALL-HSE-DOC-oo177-4)*, at the time of closure. Waste sampling methods for typical types of wastes that are managed at the HWPF and that are listed in the procedure include:

TYPE OF WASTE	METHOD REFERENCE
Extremely viscous liquid	ASTM Standard D140-70
Crushed or powdered material	ASTM Standard D346-75
Soil or rock-like material	ASTM Standard D420-69
Soil-like material	ASTM Standard D1452-65
Fly-ash-like material	ASTM Standard D2234-76
Containerized liquid waste	"Coliwasa" from *SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, USEPA

For purposes of this closure plan, target analytes for the decontamination confirmation samples will include metals, PCBs, volatile organic compounds and semi-volatile organic compounds. Wipe samples will be analyzed for metals, PCBs and semi-volatile organic compounds only. Pesticides and herbicides are not used at the Prudhoe Bay facility and are not planned for inclusion in the target analytes list at this time. The list of analytes in Table 1 (Tier II Action Levels) and PCBs is presented as the initial list of compounds that will be included for analysis. A summary of the analytical methods to be used during closure activities, the associated sample handling procedures, and the rationale for analyses are provided in Table 2. Table 3 provides the RCRA Toxicity Characteristic Leaching Procedure (TCLP) maximum concentrations that are referred to in Table 2, for waste characterization. The latest guidance available in SW-846 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* the *RCRA Waste Sampling Draft Technical Guidance*, and other appropriate sources will be used to determine the final approved analytical methods at the time of closure.

For purposes of this closure plan, the U. S. EPA-approved *Quality Assurance Project Plan for Administrative Order for Corrective Action Under 3008(h) of the Resource Conservation and Recovery Act (RCRA) - BPXA' s Prudhoe Bay Facility, Environmental Protection Agency ID No. AKD000643239, EPA Docket No.: RCRA-10-2007-0222., October 3, 2007. Revision 0, Addendum 1 April, 2017, or any subsequent revision of this QAPP approved by EPA,* is incorporated by reference. All sampling under the closure plan will follow the RCRA Quality Assurance Project Plan (QAPP) for the facility that is current and approved at the time of closure. The QAPP will provide the appropriate quality assurance (QA) and quality control (QC) measures to be applied during facility closure and to stipulate requirements/criteria associated with the following:

- QA objectives
- Laboratory procedures
- General sample collection, handling and preservation
- Laboratory custody procedures
- Calibration and maintenance procedures and protocols for laboratory equipment
- Data reduction, validation, and reporting procedures
- Internal QC checks
- QA performance and system audits
- Preventive maintenance procedures and schedules
- Data assessment procedures, including processing, interpretation, and presentation
- Corrective actions
- QA reports

The laboratory that analyzes the samples will use best accepted practices at that time, such as use of EPA-approved analytical methods; adherence to QA and QC programs; certification by state and/or federal agencies when applicable; and observance of sample holding time dates. Results will be reported in normal unit conversions (e.g., ug/l or mg/l for aqueous and TCLP samples; ug/kg or mg/kg for solid/soil samples; or ug/ or mg/wipe for the wipe samples). Results will be reported to the laboratory reporting limit or method detection limit depending on which limit is necessary to meet project data quality objectives.

3.6 Waste Containers [40 CFR 267.176]

The removal of containers of hazardous waste that were stored at the HWPF or generated as a result of closure activities will be verified by an independent registered professional engineer. Containers will be sealed and labeled prior to shipment in accordance with RCRA and DOT regulatory requirements. HNS will manifest all of the final containers of hazardous waste from the HWPF to one or more of the RCRA permitted TSDFs on contract at that time. Uniform Hazardous Waste Manifests will be prepared for all offsite shipments of hazardous waste; copies of the manifests will be maintained by HNS as required in regulations and HNS record retention policies.

HNS has contracts for hazardous waste transportation and disposal services with Clean Harbors Environmental Services, Inc. at 2231 Cinnabar Loop, Anchorage, AK 99507 (EPA ID# AKD000204842), which typically ships hazardous waste from HNS facilities to the Clean Harbors Environmental Services, Inc. TSD facility at 26328 79th Ave South, Kent Washington 98032 (EPA ID# WAH000035842). Clean Harbors Environmental Services, Inc. transports hazardous waste from HNS facilities using either their own EPA Transporter ID# MAD039322250, Alaska Marine Lines, EPA ID# WAD991281809 or Carlile Transportation Systems, EPA Transporter ID# AKR000005611 as applicable. There are currently no permitted commercial RCRA TSD facilities in Alaska; therefore, hazardous waste from HNS facilities are ultimately manifested to permitted facilities out of state.

HNS may or may not have contracts with the companies mentioned above or other hazardous waste management companies at the time of final closure. HNS periodically reviews contracts with permitted off-site commercial TSDFs and audits their facilities. Based on these reviews and audits, the list of TSDFs during the closure activities may include these and/or other permitted off-site commercial TSDFs. HNS does not consider compliance with this closure plan to be contingent upon amending this closure plan if the names, addresses, or statuses of the TSD facilities named above change in any way prior to HNS's submittal of the notification of final closure; nor will HNS amend the closure plan if HNS no longer maintains a contract with any of the named companies. These are the TSD facilities that HNS would include if HNS were closing the HWPF at the time this closure plan is submitted as part of the standardized permit application. They are also described in accordance with 40 CFR 267.112(b)(3) regarding the types of off-site hazardous waste management units to be used for removing, treating, storing, or disposing of all hazardous wastes. The selected TSD facilities will either manage the hazardous waste in permitted regulated units at their facilities or transfer the hazardous waste to other RCRA permitted TSD facilities accompanied by another manifest for further hazardous waste management, as is the current common practice.

3.7 Non-Applicable Requirements [40 CFR 267.111(c), .201, and .1108]

No hazardous waste tank systems or containment buildings are located at the HWPF storage unit or within the Prudhoe Bay facility.

3.8 Closure Certification [40 CFR 267.117]

A certification that the HWPF has been closed following the approved closure plan will be submitted to EPA by registered mail within 60 days of completion of closure. The certification will be signed by the owner-operator (HNS) and by an independent registered professional engineer. Accompanying this certification will be documentation supporting the independent registered professional engineer's certification. HNS will identify the independent registered professional engineer for EPA in HNS's notice of closure.

The engineer will certify the facility closure, based on completion of the following activities:

- Review operation logs and reports from decontamination and sampling
- Review confirmation wipe sample analyses and verify compliance with closure performance standards
- Review manifest and accompanying documentation regarding shipment of hazardous wastes offsite from the RCRA Storage Facility, and receipt by designated waste disposal destination
- Review historical logs of past spills and releases from the unit that may have entered the environment
- Inspect facility for confirmation of waste removal and lack of staining or other evidence of incomplete waste removal

The closure report will include written documentation, which was completed during closure, that these activities have been completed. The closure report will include, at a minimum:

- Documentation of all closure activities
- Summary of all analytical data, including raw laboratory data and QA/QC data, produced during the closure activities
- Description and rationale for all variations or departures from the closure plan
- Verification sample results and comparison to closure performance standards
- Drawings, diagrams, photo log documentation for sampling locations and other relevant on-site activities and visual observations during closure activities
- Provision for certification by the owner-operator
- Provision for certification by the independent registered engineer

3.9 Post-Closure Care

Regulated container storage units are not subject to post-closure requirements in 40 CFR 264, Subpart G; therefore, no post-closure care is anticipated for the facility. The HWPF will be decontaminated and all hazardous waste and hazardous waste residues will be removed at the time of closure.

4 PLAN AMENDMENTS [40 CFR 267.112(c)]

In the event that operating plans, facility design, or the approved closure plan change during operation of the permitted RCRA facility, a written request for a permit modification will be submitted to EPA at least 60 days prior to implementing the change.

5 SCHEDULE

5.1 Notification of Final Closure [40 CFR 267.112(d)]

Regulatory agencies will be informed of HNS's intent to close the facility at least 45 days before closure activities are initiated, by the submittal of a written notification of final closure. This notification will be sent to EPA Region 10, the Alaska Department of Natural Resources, and the Alaska Department of Environmental Conservation.

5.2 Closure Schedule [40 CFR 267.112(b)(6)]

The exact time of closure is currently unknown, but HNS does not anticipate closing the storage unit during the 10-year term of the permit. When closure does take place, the following estimated schedule will be followed (Day 0 is the last day that waste is accepted at the facility and the day closure begins):

Day	Activity
-45	Submit the written notification of final closure
0	No further wastes or hazardous materials are accepted at HWPF, and closure activities are initiated
30	If delayed, closure activities are initiated by this date.
90	All hazardous waste are shipped off-site and hazardous residues decontaminated by this date
120	Complete closure activities, including confirmation sampling
180	Certification of closure

Extensions of Closure Schedule [40 CFR 267.115]

If an extension of up to 180 days is necessary to achieve final closure (i.e., if final closure will not be completed within 180 days of the final volume of hazardous waste being accepted at the HWPF), a petition will be filed with EPA Region 10. This notice will be sent at least 30 days prior to the expiration of the initial 180 day period. To justify an extension or an amendment of the closure schedule presented above, HNS will demonstrate the need for more than 180 days to implement final closure due to circumstances beyond HNS's control and steps that have and will continue to be taken to prevent threats to human health and the environment from the unclosed but inactive facility. For example, HNS may need to request an extension to accommodate the seasonal timing of sampling soil or gravel and super-permafrost groundwater under and adjacent to the HWPF (if required) since the gravel pads and porewater in the Prudhoe Bay facility only thaw between June and September.

6. CLOSURE COST ESTIMATE

An estimate of the costs associated with closure of HWPF is provided in Table 4. HNS has demonstrated its eligibility for a Letter of Credit of financial assurance based on the financial test specified in 40 CFR 267.143(g) (see section 8 of this application).

The cost estimate is based on HNS hiring a third party to close the HWPF storage unit at the point in the unit's life when the extent and manner of its operation would make closure the most expensive. No salvage value was assumed for equipment or materials.

This closure cost estimate also includes a 50% contingency to account for wide variation in the actual inventory of waste stored, types of waste stored and their distinct disposal costs, variation in decontamination and removal technique, sampling and analysis methodology and technique, the volume of decontaminated or contaminated equipment and other solid waste that is generated as a result of closure activities, and variation in personnel or labor rates.

During the active life of the facility, the closure cost estimate will be updated for inflation within 30 days after the close of HNS's fiscal year and before submission of annual updated financial assurance documentation to the EPA Region 10 Regional Administrator required in 40 CFR 267.143 [40 CFR 267.142(b)]. In addition, if this plan is modified during the active life of the facility, a revised closure cost estimate will be completed no later that 30 days after the Regional Administrator has approved the request to modify the closure plan, if the change in the closure plan increases the cost of closure [40 CFR 267.142(c)]. The closure plan itself will not be revised for each annual adjustment, but rather it will be reflected in the corporate guarantee HNS provides annually to EPA for financial assurance under 40 CFR 267, Subpart H. The financial assurances are mailed to the EPA Regional Administrator at the end of March of each calendar year. The most recent closure cost estimates are also included in the Biennial Reports submitted to EPA by March 1 of each even numbered year. A copy of the latest adjusted closure cost estimate will be kept at the facility as required in 40 CFR 267.142(d).

Tables and Figures

56-23-5	Carbon tetrachloride	1.4E+00	--	**3.5E-01**	**4.4E-01**	--	7.2E+01
108-90-7	Chlorobenzene	**3.9E+01**	--	1.9E+02	**7.4E+00**	--	5.3E+02
75-00-3	Chloroethane [a]	**2.8E+03**	--	NA	**2.1E+03**	--	NA
67-66-3	Chloroform	**5.8E-01**	--	1.1E+01	**2.2E-01**	--	4.9E+00
106-93-4	1,2 Dibromoethane	**6.4E-02**	--	3.4E-01	**7.2E-03**	--	2.0E+01
95-50-1	1,2 Dichlorobenzene	2.5E+02	--	**4.5E+01**	**1.8E+01**	--	3.6E+02
106-46-7	1,4 Dichlorobenzene	**3.1E+00**	--	NA	**4.1E-01**	--	NA
75-34-3	1,1 Dichloroethane	**6.7E+00**	--	NA	**2.7E+00**	--	2.0E+04
107-06-2	1,2 Dichloroethane	**8.1E-01**	--	1.8E+00	**1.7E-01**	--	4.2E+02
75-35-4	1,1 Dichloroethene	4.9E+01	--	**1.0E+01**	**2.7E+01**	--	NA
156-59-2	cis 1,2 Dichloroethene	5.4E+01	--	**4.4E+01**	**3.2E+00**	A	2.0E+04
156-60-5	trans 1,2 Dichloroethene	5.4E+02	--	**5.9E+01**	**3.2E+01**	--	2.0E+04
60-29-7	Diethyl ether	5.4E+03	--	**9.6E+02**	**3.6E+02**	--	2.6E+05
123-91-1	1,4 Dioxane	1.7E+01	A	**2.8E+00**	**4.6E-01**	--	NA
100-41-4	Ethylbenzene	**7.3E+00**	--	3.6E+02	**1.3E+00**	--	2.2E+02
50-00-0	Formaldehyde	3.1E+01	B	**4.7E-01**	**3.8E-01**	B	1.9E+03
98-82-8	Isopropylbenzene (Cumene)	**2.7E+02**	--	NA	**4.0E+01**	--	NA
67-56-1	Methanol	4.0E+04	A	**1.4E+00**	**2.0E+03**	--	3.3E+05
75-09-02	Methylene chloride	1.0E+02	--	**1.7E+01**	**8.2E+00**	--	1.0E+04
108-10-1	4 Methyl 2 pentanone	6.8E+03	--	**1.2E+01**	**6.3E+02**	--	3.9E+03
100-42-5	Styrene	**9.3E+02**	--	NA	**1.1E+02**	--	NA
103-65-1	n Propylbenzene	6.3E+02	--	**5.2E+02**	**4.1E+01**	A	1.6E+02
79-34-5	1,1,2,2 Tetrachloroethane	**9.4E-01**	--	NA	**7.3E-02**	--	NA
127-18-4	Tetrachloroethene	1.5E+01	--	**1.0E+01**	**3.2E+00**	--	NA
108-88-3	Toluene	1.2E+03	--	**3.8E+00**	**1.0E+02**	--	7.0E+02
71-55-6	1,1,1 Trichloroethane	1.6E+03	--	**1.0E+02**	**7.9E+02**	--	1.3E+03
79-00-5	1,1,2 Trichloroethane	**2.3E-01**	--	NA	**4.1E-02**	--	NA
79-01-6	Trichloroethene	**7.4E-01**	--	4.5E+00	**2.7E-01**	--	NA
75-69-4	Trichlorofluoromethane	**8.0E+03**	--	NA	**4.1E+02**	--	NA
96-18-4	1,2,3 Trichloropropane	**1.7E-02**	--	NA	**6.5E-04**	--	NA
95-63-6	1,2,4 Trimethylbenzene	**4.7E+01**	--	4.4E+02	**3.7E+00**	A	3.6E+02
108-67-8	1,3,5 Trimethylbenzene	4.1E+01	--	**1.4E+01**	**3.3E+00**	A	NA
75-01-4	Vinyl chloride	**7.0E-02**	--	1.5E+01	**1.8E-02**	--	NA
1330-20-7	Xylenes	**7.1E+01**	--	6.6E+02	**1.9E+01**	--	8.6E+02
Semi-Volatiles							
83-32-9	Acenaphthene	1.2E+03	--	**3.0E+01**	**9.1E+00**	A	6.0E+01
208-96-8	Acenaphthylene	NA	--	NA	NA	--	NA
120-12-7	Anthracene	5.6E+03	--	**5.6E+01**	2.0E+01	A	**2.1E+00**
56-55-3	Benzo(a)anthracene	**2.5E+00**	--	NA	**2.1E-02**	--	1.0E+00
50-32-8	Benzo(a)pyrene	**2.3E-01**	--	8.9E-01	**3.7E-04**	--	5.0E-01
205-99-2	Benzo(b)fluoranthene	**2.6E+00**	--	NA	**6.2E-03**	--	1.0E+00
191-24-2	Benzo(g,h,i)perylene	NA	--	NA	NA	--	NA
207-08-9	Benzo(k)fluoranthene	**2.3E+01**	--	NA	**3.8E-02**	--	NA
91-58-7	2 Chloronaphthalene	**1.6E+03**	--	NA	**2.5E+00**	--	NA
218-01-9	Chrysene	**2.6E+02**	--	NA	**5.9E-01**	--	4.0E+02
53-70-3	Dibenz(a,h)anthracene	**1.7E-01**	--	NA	**2.0E-04**	--	4.6E-01
132-64-9	Dibenzofuran	**2.3E+01**	--	NA	**8.1E-02**	--	NA
105-67-9	2,4 Dimethylphenol	4.4E+02	--	**1.0E+01**	**3.0E+01**	--	8.1E+02
84-74-2	Di n butylphthalate	2.0E+03	--	**1.0E+00**	4.3E+01	--	**2.9E+00**
206-44-0	Fluoranthene	6.8E+02	--	**9.8E+01**	1.5E+00	--	**1.4E+00**
86-73-7	Fluorene	7.7E+02	--	**3.3E+00**	**7.7E+00**	A	2.8E+03
193-39-5	Indeno(1,2,3 cd)pyrene	**1.7E+00**	--	NA	**1.6E-03**	--	NA
90-12-0	1 Methylnaphthalene	**5.5E+01**	--	9.0E+02	**8.7E-01**	A	1.4E+02
91-57-6	2 Methylnaphthalene	7.9E+01	--	**6.4E+01**	**2.4E+00**	A	4.5E+02
95-48-7	2 Methylphenol	1.1E+03	--	**7.3E+01**	**8.1E+01**	--	NA
108-39-4	3 Methylphenol	**1.1E+03**	--	NA	**8.2E+01**	--	8.9E+02
106-44-5	4 Methylphenol	**2.2E+03**	--	NA	1.7E+02	--	**1.4E+02**
34mp	3&4 Methylphenol [b]	**1.1E+03**	--	NA	**8.2E+01**	--	1.4E+02
91-20-3	Naphthalene	**4.1E+00**	--	1.2E+01	**1.7E-01**	--	2.8E+02
85-01-8	Phenanthrene	NA	--	**3.8E+02**	NA	--	**4.8E+01**
108-95-2	Phenol	6.6E+03	--	**6.8E+00**	**4.6E+02**	--	5.5E+02
129-00-0	Pyrene	5.4E+02	--	**2.2E+01**	2.2E+00	--	**4.6E-01**
Metals							
7429-90-5	Aluminum [c]	--	--	--	--	--	--
7440-36-0	Antimony	7.2E+00	--	**2.3E-01**	**3.2E-01**	--	6.9E+01
7440-38-2	Arsenic	**1.5E+00**	--	1.0E+01	**1.1E-02**	--	3.2E+01
7440-39-3	Barium	5.1E+03	--	**4.0E+02**	**3.6E+02**	--	5.8E+03
7440-43-9	Cadmium	1.5E+01	--	**9.2E-01**	3.9E-01	--	**3.2E-01**
7440-47-3	Chromium	NA	--	NA	NA	--	NA
16065-83-1	Chromium (III)	3.7E+04	--	**1.0E+01**	**2.2E+03**	--	NA
18540-29-9	Chromium (VI)	9.3E-01	--	**4.0E-01**	**1.2E-02**	--	NA
7440-50-8	Copper	9.7E+01	--	**3.6E+00**	2.0E+01	--	**1.1E+00**
7439-92-1	Lead	NA	--	**5.0E+01**	NA	--	**2.4E+01**
7439-96-5	Manganese [c]	--	--	--	--	--	--
7439-97-6	Mercury	**1.4E-02**	--	2.6E-01	**2.4E-02**	--	9.1E-01
7440-02-0	Nickel	2.8E+02	--	**9.0E+01**	**1.6E+01**	--	1.0E+02
7782-49-2	Selenium	7.0E+01	--	**8.5E-01**	2.6E+00	--	**2.0E+00**
7440-22-4	Silver	3.4E+01	--	**1.5E+01**	8.8E+00	--	**2.0E-02**
7440-62-2	Vanadium	1.3E+02	--	**2.5E+01**	**8.6E+00**	--	1.7E+03
7440-66-6	Zinc	**3.0E+01**	--	7.2E+02	**3.9E+01**	--	7.5E+01
Inorganics							
57-12-5	Cyanide	6.8E+00	A	**3.6E+00**	**1.5E-01**	--	5.2E+00
Glycols							
107-21-1	Ethylene glycol	**1.0E+04**	--	NA	**2.7E+03**	--	NA

Bold values indicate Tier II action level drivers

Abbreviations:

CAS#: Chemical Abstract Services registry number

Table Source:

2019 RCRA Annual Report, Prudhoe Bay Facility, Alaska, Administrative Order d

Table 2 Analytical Methods, Handling and Rationale for Analyses

Analysis and Method	Recommended Container	Preservative	Holding Time	Rationale
Ignitability (flash point) 1010A (Pensky-Martens closed cup) 1020A (Setaflash closed cup)	250 ml glass, Teflon-lined cap	Chill to 4°C	7 Days	Hazardous waste determination for disposal of HWPF onsite waste inventory (liquids) and closure decontamination rinsate.
Corrosivity (pH) 9040C (Electronic meter) 9045D (Soil and waste pH)	250 ml polyethylene/glass	None	Field analysis: As soon as possible Lab analysis: 24 hours	Hazardous waste determination for disposal of HWPF onsite waste inventory and closure decontamination rinsate.
Reactivity Generator knowledge (See Exhibit 7B)				Hazardous waste determination for disposal of. HWPF onsite waste inventory.
Toxicity Characteristic Leaching Procedure (TCLP) Extraction 1311	See below	See below	See below	Hazardous waste determination for disposal of HWPF onsite waste inventory and closure decontamination waste.
TCLP Metals 6010/6020 or 7000 series 7470 (Mercury: aqueous) 7471 (Mercury: soil/solid) Arsenic. Barium Cadmium Lead Mercury Selenium Silver Chromium	Aqueous: 1000 mL plastic Soil/Solid: 8-oz. wide mouth jar	Cool to ≤6º	TCLP extraction within: 180 days except mercury (28 days) Prep and Analysis of TCLP leachate within: 180 days except mercury (28 days) Total days 56 for mercury, 360 days for metals	Hazardous waste determination for disposal of HWPF onsite waste inventory and closure decontamination waste.
Total Metals 6010/6020 or 7000 series 7470 (Mercury: aqueous) 7471 (Mercury: soil/solid)	Aqueous: 500 mL plastic	HNO_3 to pH≤2; Cool to ≤6ºC or ambient	180 days except mercury (28 days)	Verification samples, including wipe samples, to document closure performance standards were met, including wipe samples.
	Soil/Solid: 8-oz. wide mouth jar	Cool to ≤6ºC		
TCLP and Total Volatile Organics 8260B or equivalent (aqueous) 5035/8260B (soil/solid) Note: TCLP volatiles may require larger volumes of sample in the event of low percent solids	Aqueous: 40 ml VOA vials with septa, no headspace	Aqueous: HCL to pH<2 (unless analyzed within 7 days), Cool to ≤6ºC	Totals: 14 days	TCLP analyses: Hazardous waste determination for disposal of HWPF onsite inventory and decontamination waste. Total analyses: verification samples to document closure performance standards are met, excluding wipe samples.
	TCLP Soil/Solid: 8-oz. wide mouth jar	Cool to ≤6ºC	TCLP Extraction of sample within 14 days Analysis of TCLP leachate: 14 days (total 28 days)	
	Soil/Solid: Tared 40 ml VOA with 5 ml DI water, 5 grams sample for each vial	Soil/Solid: Cool to ≤6ºC in field, frozen to ≤10ºC at laboratory	Totals: 14 days	

Analysis and Method	Recommended Container	Preservative	Holding Time	Rationale
Polychlorinated Biphenyls (PCBs) 8082	Aqueous: 1 liter amber glass; Teflon-lined cap	Chill to ≤6ºC	Extract within 7 days, analyze within 40 days of extraction	Total analyses: Verification samples to document closure performance standards
	Soil/Solid: 8-oz. amber wide-mouth jar		Extract within 14 days, analyze within 40 days of extraction	
TCLP and Total Semi-volatile Organics 8270C	Aqueous: 1liter amber glass, Teflon-lined cap Soil/Solid: 8-oz. amber wide-mouth jar	Chill to ≤6ºC	TCLP Extraction within: 14 days, Preparation of TCLP Extract within 7 days, analyze within 40 days of extraction (61 total days) Aqueous Totals: 7 days to extraction, 40 days to analysis Soil/Solid Totals: 14 days to extraction, 40 days to analysis	TCLP analyses: Hazardous waste determination for disposal of HWPF onsite waste inventory, decontamination rinsate. Total analyses: verification samples to document closure performance standards are met, including wipe samples
WIPE SAMPLES				
Total Semi-volatile Organics 8270C	Premoistened 2"x2" gauze pad and methanol returned in 2-oz. glass jar	None	14 days to extraction, 40 days to analysis	Total analyses: Verification samples to document closure performance standards
Polychlorinated Biphenyls (PCBs) 8082	Premoistened 2"x2" gauze pad and hexane returned in 2-oz. glass jar	None	14 days to extraction, 40 days to analysis	Total analyses: Verification samples to document closure performance standards
Total Metals 6010/6020 7471 (Mercury: soil/solids)	"Ghost Wipes" premoistened with deionized water and a plastic vessel for storage	None	180 days, except mercury (28 days)	Total analyses: Verification samples to document closure performance standards

See *Quality Assurance Project Plan For Administrative Order for Corrective Action Under Section 3008(h) of the Resource Conservation and Recovery Act (RCRA) – BPXA's Prudhoe Bay Facility, Environmental Protection Agency ID No AKD 000643239, EPA Docket No.: RCRA-10-2007-0222, October 3, 2007* for additional sample handling and analytical methods requirements, including matrix QC samples (e.g., MS, MSD, and/or laboratory duplicate samples, trip samples for volatiles).

Table 3 Maximum Concentrations of Contaminants for the Toxicity Characteristic

As determined by Toxicity Characteristic Leaching Procedure [40 CFR 261.24]

Contaminant	Maximum concentration (mg/L)	Contaminant	Maximum concentration (mg/L)
TCLP Metals		**TCLP Semi-Volatiles**	
Arsenic	5.0	o-Cresol	200.0*
Barium	100.0	m, p-Cresol	200.0*
Cadmium	1.0	m, p-Cresol	200.0*
Chromium	5.0	Cresol (total)	200.0*
Lead	5.0	2,4-Dinitrotoluene	0.13**
Mercury	0.2	Hexachlorobenzene	0.13**
Selenium	1.0	Hexachlorobutadiene	0.5
Silver	5.0	Hexachloroethane	3.0
		Nitrobenzene	2.0
TCLP Volatiles		Pentachlorophenol	100.0
Benzene	0.5	Pyridine	5.0**
Carbon tetrachloride	0.5	2,4,5-Trichlorophenol	400.0
Chlorobenzene	100.0	2,4,6-Trichlorophenol	2.0
Chloroform	6.0		
1,4-Dichlorobenzene	7.5		
1,2-Dichloroethane	0.5		
1,1-Dichloroethylene	0.7		
Methyl ethyl ketone	200.0		
Tetrachloroethylene	0.7		
Trichloroethylene	0.5		
Vinyl chloride*	0.2		

* If o-, m-, and p-cresol concentrations cannot be differentiated, the total cresol concentration is used.

** Method quantitation limit is higher than regulatory limit. Use quantitation limit as maximum allowable level.

Note: Pesticides and herbicides are not used or expected to be present at HNS; therefore, no testing for TCLP Pesticides/Herbicides is included.

Table 4 Closure Cost Estimate

	Rate	Units	No	Cost
Task 1 Record Review, Closure, QAPP and HSE Plan Prep, Agency Meetings	$175	hour	191	**$33,377**
Task 2 Inventory Disposal (max inventory, 444 drums including bulbs/lamps)				**$449,550**
Drum Sampling, Pkg, Labeling	$72	hour	320	$23,144
Profile & Laboratory Analysis	$583	drum	222	$129,395
Shipping from Prudhoe to Anchorage	$6,408	truck	10	$64,075
Chlorinated Solvent/ Waste Oil Disposal	$408	drum	40	$16,310
Lamp/Bulb Disposal (containing lead and mercury)	$565	drum	52	$29,381
Mercury-contaminated waste	$4,806	drum	10	$48,056
Flammables and Off-Spec Oil Disposal (passes on halogens)	$155	drum	266	$41,215
Lab packs and medical waste	$571	drum	20	$11,417
Aqueous Acid/Base/Metals Disposal	$439	drum	56	$24,595
Shipping from Anchorage to Seattle	$140	drum	444	$62,071
Task 3 Facility Decontamination/Removal				**$42,778**
3.1 Dismantle and clean equipment				
Technicians	$72	hour	80	$5,778
Heavy Equipment	$350	hour	40	$13,980
3.2 Haul equipment to Fairbanks	$2,913	truck	4	$11,650
3.3 Landfill disposal charge	$142	yard	80	$11,370
Task 4 Sampling and Analysis				**$84,664**
4.1 Sample collection				
Labor	$72	hour	288	$20,736
Consumables				$3,500
4.2 Analytical Testing – See Table 5	$21,464	each	2	$42,928
4.3 Analysis Evaluation/Recommendations	$175	hour	100	$17,500
Task 5 Disposal of Decontamination Wastes				**$15,238**
5.1 Decontamination Solids Disposal	$175	drum	8	$1,398
5.2 Decontamination Rinsate Disposal	$140	drum	20	$2,796
5.3 Drum Profiling, Pkg, Labeling	$72	hour	10	$722
5.5 Shipping from Prudhoe to Anchorage	$6,408	truck	1	$6,408
5.6 Shipping from Anchorage to Seattle	$140	drum	28	$3,914
Task 6 Closure Certification by Engineer	$175	hour	200	**$34,950**
Tasks 1-6 Contractor Travel and Per Diem				**$15,552**
Travel: Round trip Anchorage-Deadhorse	$961	trip	8	$7,689
Per Diem: Deadhorse lodging	$175	night	45	$7,864
Task 7 50% Contingency				**$367,488**
TOTAL ESTIMATED CLOSURE COSTS:				**$1,041,599**

Table 5 Closure Sample Analytical Cost Worksheet

Closure Sampling Options

PCB Area (1 corner) - Systematic grid sampling, random start with select judgemental locations		**Analytical Cost**	**Revised Sample Quantities: Systematic**	**Judgemental**	**Total**	**Total Cost**
Systematic + - Dirty Area - Wall	Wipe Sample (PCB)	$40	6	2	8	$320
Systematic+ - Dirty Area - Floor	Concrete Sample (PCB)	$40	6	2	8	$320
Background Wipe	Wipe Sample (PCB)	$40	0	2	2	$80
Background Concrete	Concrete Sample (PCB)	$40	0	2	2	$80
	All Option 2 Samples				**20**	**$800**

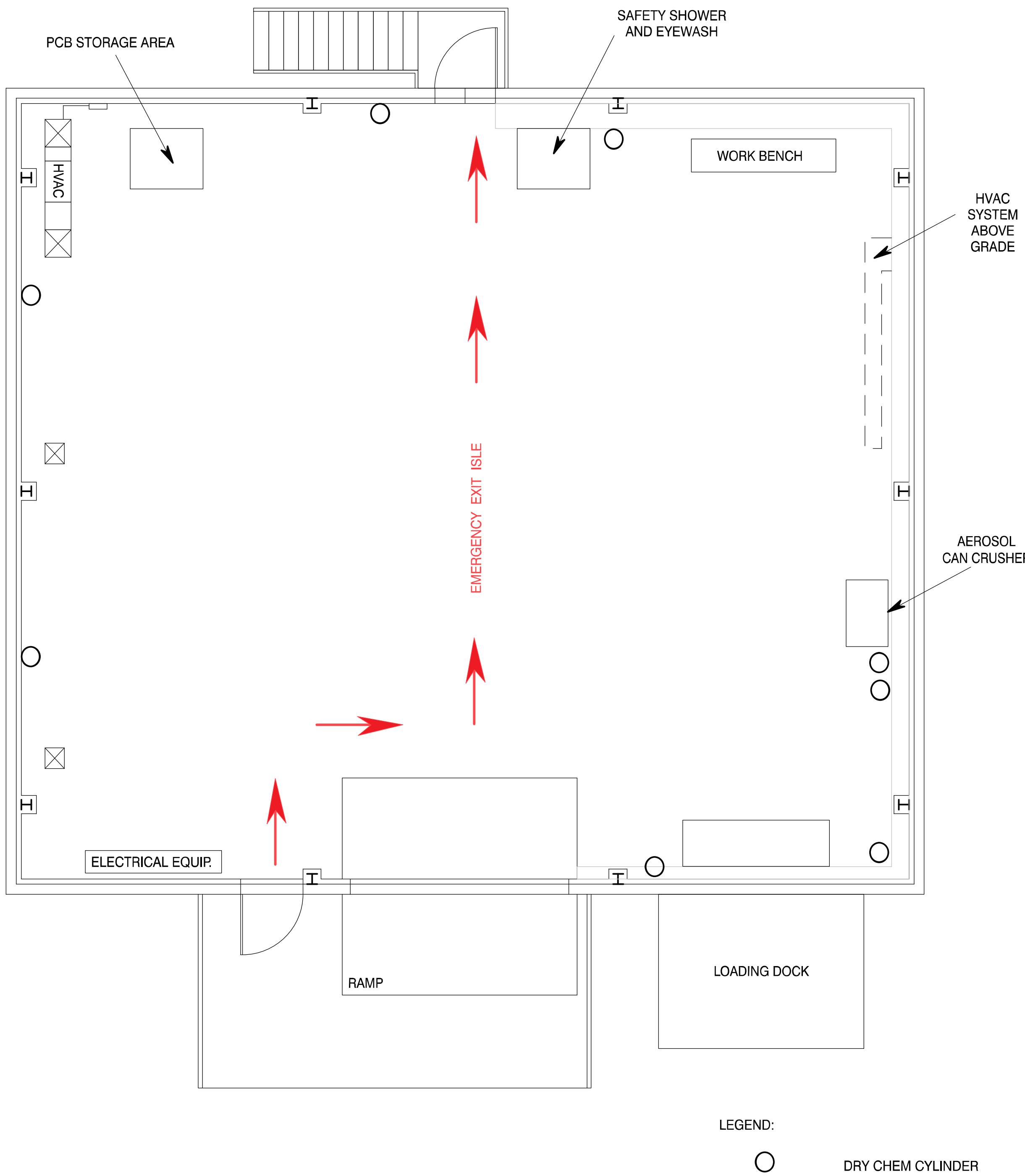
No release/Limited Release - Random sampling in building with select judgemental and background locations; sytematic grid for outside loading area		**Analytical Cost**	**VSP - Random/ Systematic**	**Judgemental**	**Total**	**Total Cost**
Random+ - Walls	Wipe Sample (Metals, SVOCs)	$272	9	4	13	$3,536
Background - Wipes	Wipe Sample (Metals, SVOC)	$272	0	2	2	$544
Random + - Floor	Concrete Sample (Metals, SVOC)	$272	9	3	12	$3,264
Background - Concrete	Concrete Sample (Metals, SVOC)	$272	0	2*	2	$544
Systematic - Loading	Soil/Concrete/Gravel Sample (Metals, SVOC, VOC)	$332	9	0	9	$2,988
	All Option 1 Samples				**38**	**$10,876**

Multiple Releases - Predetermined (18) random sampling in building with select judgemental and background locations; Predetermined (18) sytematic grid for outside loading area		**Analytical Cost**	**VSP - Random/ Systematic**	**Judgemental**	**Total**	**Total Cost**
Predetermined (18) Random+ - Walls	Wipe Sample (Metals, SVOCs)	$272	18	8	26	$7,072
Background - Wipes	Wipe Sample (Metals, SVOC)	$272	0	2	2	$544
Predetermined (18) Random + - Floor	Concrete Sample (Metals, SVOC)	$272	18	6	24	$6,528
Background - Concrete	Concrete Sample (Metals, SVOC)	$272	0	2*	2	$544
Predetermined (18) Systematic + - Loading Area	Soil/Concrete Sample (Metals, SVOC, VOC)	$332	18	0	18	$5,976
	All Option 1 Samples				**72**	**$20,664**

Minimum Closure Costs	PCB Area with No/Limited Release Sample Analysis	**$11,676**
Maximum Closure Costs (1 dirty area)	PCB Area with Multiple Release Sample Analysis	**$21,464**

Assumptions:
Building Floor Area - 50 ft. x 60 ft. = 3000 sq.ft.
Wall Height - 9 ft. ; Maximum Wall Areas = 2 (50 ft. x 9 ft. = 450 sq. ft.) + 2 (60 ft. x 9 ft. = 540 sq. ft.) = 1980 sq. ft. (3 Door areas were subtracted)
* Background Concrete - 2 composites from clean locations
Dirty Floor Area - 20 ft x20 ft; 400 sq ft.
Dirty Wall Height - 15 ft; 1 Wall Section 20 ft. x 15 ft.; 300 sq. ft.
Loading Area (Gravel Pad/Concrete Ramp) - 40 ft. x 20 ft. = 800 sq. ft.
Size of additional Dirty Areas was estimated from the PCB storage Area and initial Gravel Loading Area

Figure 1 HWPF Floor Plan



NOTES:

1. FLOOR PLAN SHOWN IS HYPOTHETICAL FOR MAXIMUM STORAGE QUANTITY ESTIMATION. STORAGE AND PROCESSING WILL BE ARRANGED WITHIN THE WORK AREA TO MEET THE FOLLOWING CONSTRAINTS.

a. MINIMUM ISLE SPACE OF 3 FEET WILL BE PROVIDED AT ALL TIMES

2. DRUMS WITHIN THE WORK AREA MAY BE DOUBLE-STACKED, EXCEPT FOR THE CLASS 1 FLAMMABLES.

3. THERE IS RACK STORAGE SPACE FOR 13 BOXES OR 52 DRUMS OF LIGHT BULBS ALONG 2 WALLS.

HILCORP NORTH SLOPE, LLC

HAZARDOUS WASTE PROCESS FACILITY FLOOR PLAN

DATE:	SCALE:	FIGURE:
January 2021	NOT TO SCALE	1

ms16895_RCRA_fig1.cdr

Attachment 1 Visual Sample Plan Summaries

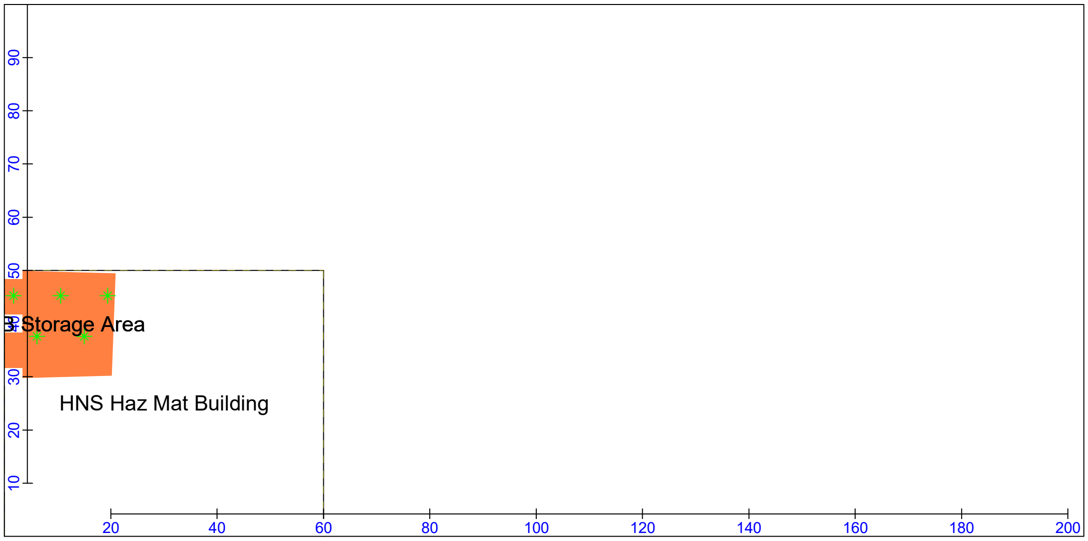
Systematic sampling locations for comparing a mean with a fixed threshold (nonparametric)

Summary
This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Systematic grid with a random start location
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon signed ranks test
Calculated total number of samples	6
Number of samples on map [a]	6
Number of selected sample areas [b]	1
Specified sampling area [c]	407.88 ft^2
Size of grid / Area of grid cell [d]	8.85978 feet / 67.9793 ft^2
Grid pattern	Triangular
Total cost of sampling [e]	$240.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Size of grid / Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.
[e] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: PCB Storage Area						
X Coord	Y Coord	Label	Value	Type	Historical	Sample Area
1.7313	29.9061			Systematic		
6.1612	37.5789			Systematic		
15.0210	37.5789			Systematic		
1.7313	45.2517			Systematic		
10.5911	45.2517			Systematic		
19.4509	45.2517			Systematic		

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A nonparametric systematic sampling approachwith a random start was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

VSP offers many options to determine the locations at which measurements are made or samples are collected and subsequently measured. For this design, systematic grid point sampling was chosen. Locating the sample points systematically provides data that are all equidistant apart. This approach does not provide as much information about the spatial structure of the potential contamination as simple random sampling does. Knowledge of the spatial structure is useful for geostatistical analysis. However, it ensures that all portions of the site are equally represented. Statistical analyses of systematically collected data are valid if a random start to the grid is used.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Wilcoxon Signed Ranks test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of

samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S^2_{sample} + \frac{S^2_{analytical}}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z^2_{1-\alpha}\right]$$

where

n is the number of samples,
S is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the gray region,
α is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
β is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n	Parameter					
		S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
PCB	6	0.2 mg/kg	0.5 mg/kg	0.01	0.1	2.32635	1.28155

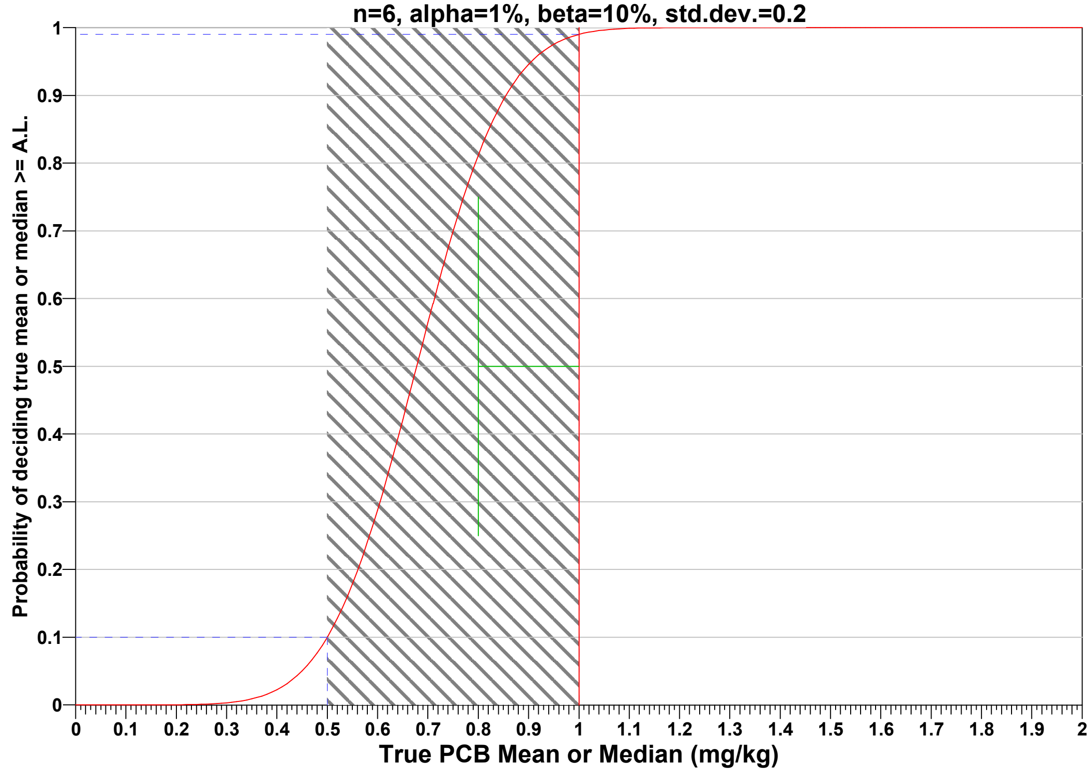
[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.

Wilcoxon Signed Rank (One-Sample) Test

n=6, alpha=1%, beta=10%, std.dev.=0.2



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the data originate from a symmetric (but not necessarily normal) population,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
AL=1		α=5		α=10		α=15	
		s=0.4	s=0.2	s=0.4	s=0.2	s=0.4	s=0.2
LBGR=90	β=5	203	52	160	41	135	34
	β=10	161	42	123	32	101	26
	β=15	136	35	101	26	81	21
LBGR=80	β=5	52	15	41	11	34	9
	β=10	42	12	32	9	26	7
	β=15	35	10	26	8	21	6
LBGR=70	β=5	24	8	19	6	16	5
	β=10	20	6	15	5	12	4
	β=15	17	6	13	4	10	3

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $240.00, which averages out to a per sample cost of $40.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**6 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (PCB)	$40.00	$40.00	$240.00
Sum of Field & Analytical costs		**$40.00**	**$240.00**
Fixed planning and validation costs			$0.00
Total cost			**$240.00**

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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* - The report contents may have been modified or reformatted by end-user of software.

Systematic sampling locations for comparing a mean with a fixed threshold (nonparametric)

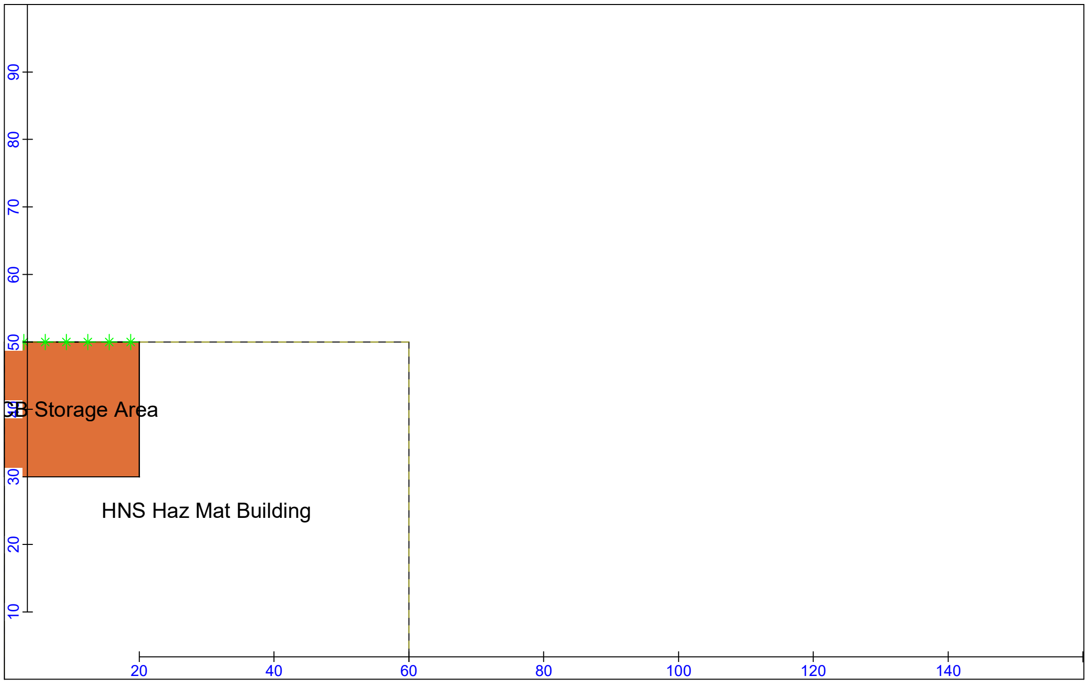
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Systematic grid with a random start location
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon signed ranks test
Calculated total number of samples	6
Number of samples on map [a]	6
Number of selected sample areas [b]	1
Specified sampling area [c]	300.00 ft^2
Size of grid / Area of grid cell [d]	6.33196 feet / 34.7222 ft^2
Grid pattern	Triangular
Total cost of sampling [e]	$240.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Size of grid / Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.
[e] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: PCB Storage Area										
X Coord	Y Coord	Z Coord	Label	Value	Type	Historical	Surface	LX	LY	Sample Area
6.0384	50.0000	5.2275			Systematic		Wall 1	6.0384	5.2275	
12.3704	50.0000	5.2275			Systematic		Wall 1	12.3704	5.2275	
18.7023	50.0000	5.2275			Systematic		Wall 1	18.7023	5.2275	
2.8724	50.0000	10.7112			Systematic		Wall 1	2.8724	10.7112	
9.2044	50.0000	10.7112			Systematic		Wall 1	9.2044	10.7112	
15.5364	50.0000	10.7112			Systematic		Wall 1	15.5364	10.7112	

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A nonparametric systematic sampling approachwith a random start was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

VSP offers many options to determine the locations at which measurements are made or samples are collected and subsequently measured. For this design, systematic grid point sampling was chosen. Locating the sample points systematically provides data that are all equidistant apart. This approach does not provide as much information about the spatial structure of the potential contamination as simple random sampling does. Knowledge of the spatial structure is useful for geostatistical analysis. However, it ensures that all portions of the site are equally represented. Statistical analyses of systematically collected data are valid if a random start to the grid is used.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Wilcoxon Signed Ranks test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S_{sample}^2 + \frac{S_{analytical}^2}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z_{1-\alpha}^2\right]$$

where

n	is the number of samples,
S	is the estimated standard deviation of the measured values including analytical error,
Δ	is the width of the gray region,
α	is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
β	is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n	Parameter					
		S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
PCB	6	1 ug/100 cm2	1 ug/100 cm2	0.05	0.4	1.64485	0.253347

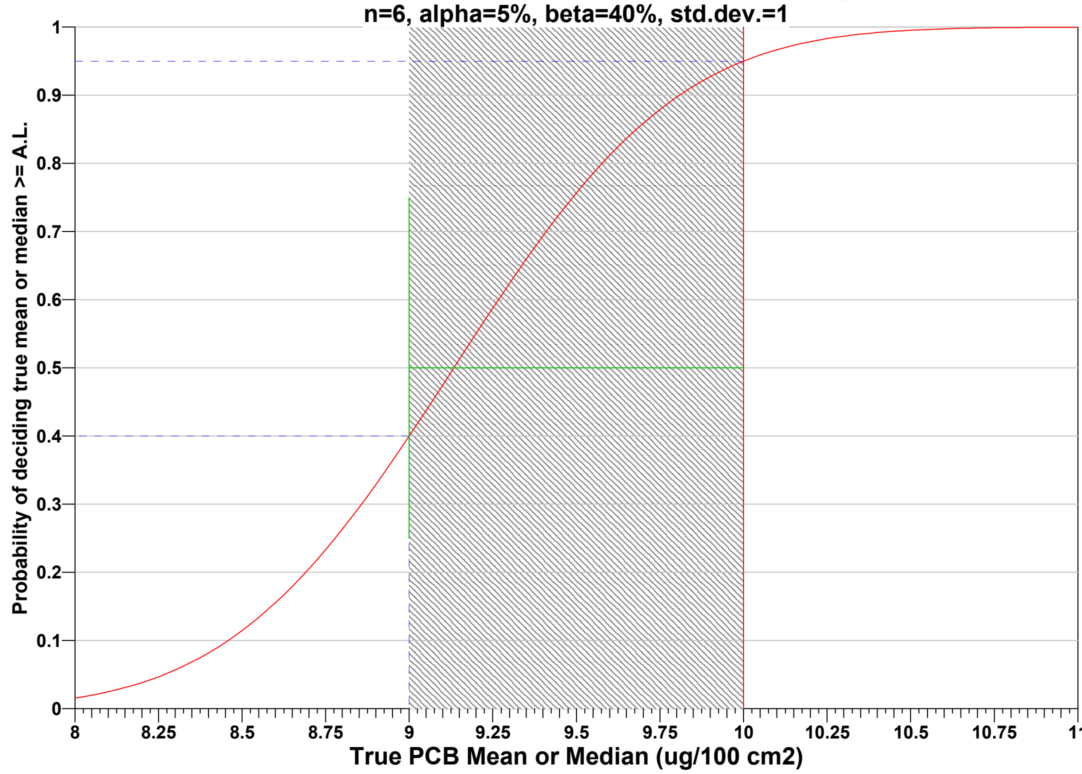
[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.

Wilcoxon Signed Rank (One-Sample) Test

n=6, alpha=5%, beta=40%, std.dev.=1



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the data originate from a symmetric (but not necessarily normal) population,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
AL=10		α=5		α=10		α=15	
		s=2	s=1	s=2	s=1	s=2	s=1
LBGR=90	β=35	21	7	14	5	11	3
	β=40	19	6	12	4	9	3
	β=45	17	6	11	4	7	3
LBGR=80	β=35	7	3	5	2	3	2
	β=40	6	3	4	2	3	2
	β=45	6	3	4	2	3	2
LBGR=70	β=35	4	3	3	2	2	1
	β=40	4	3	3	2	2	1
	β=45	4	2	2	2	2	1

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $240.00, which averages out to a per sample cost of $40.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**6 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (PCB)	$40.00	$40.00	$240.00
Sum of Field & Analytical costs		**$40.00**	**$240.00**
Fixed planning and validation costs			$0.00
Total cost			**$240.00**

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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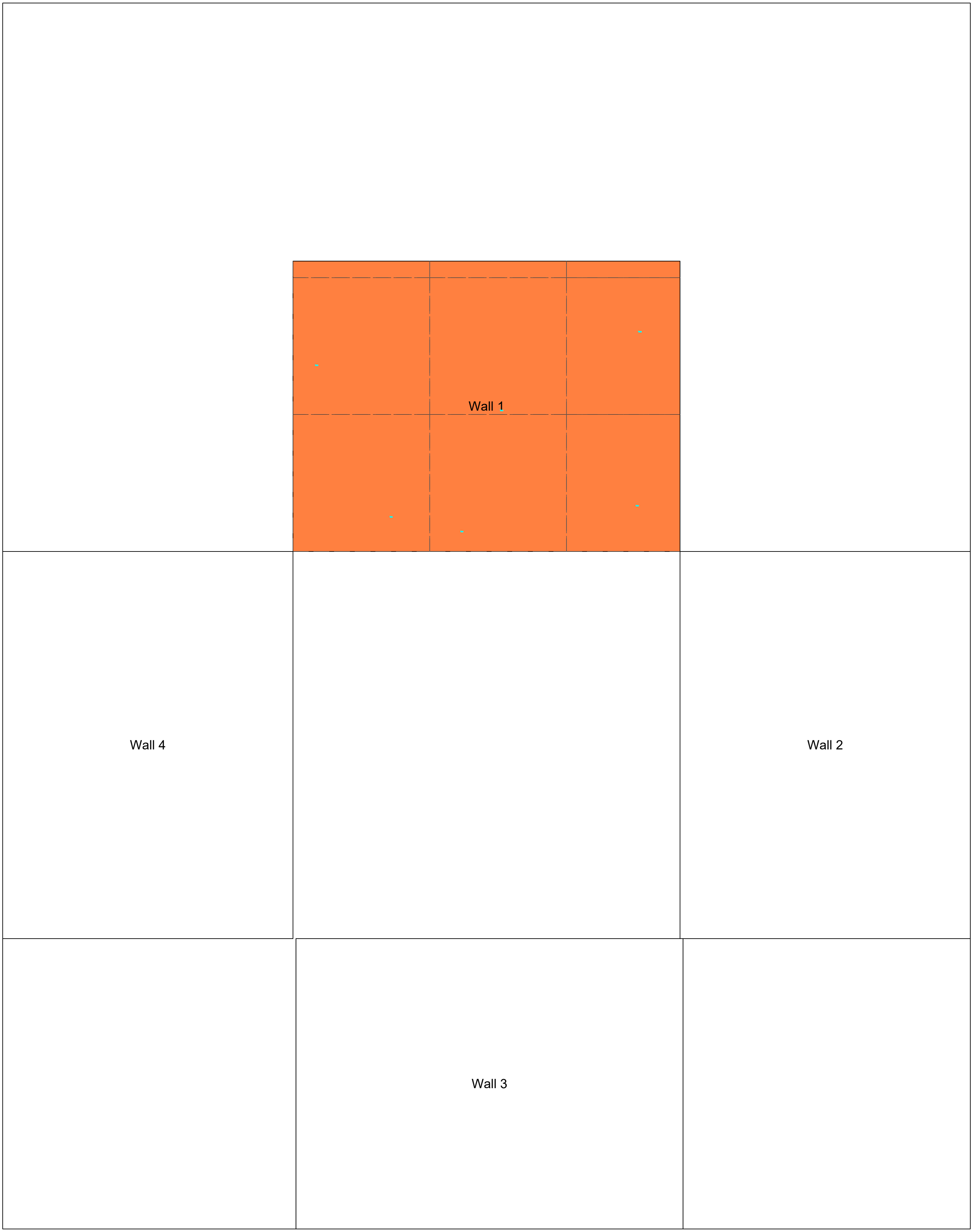
* - The report contents may have been modified or reformatted by end-user of software.


Wall 1
Wall 4
Wall 2
Wall 3

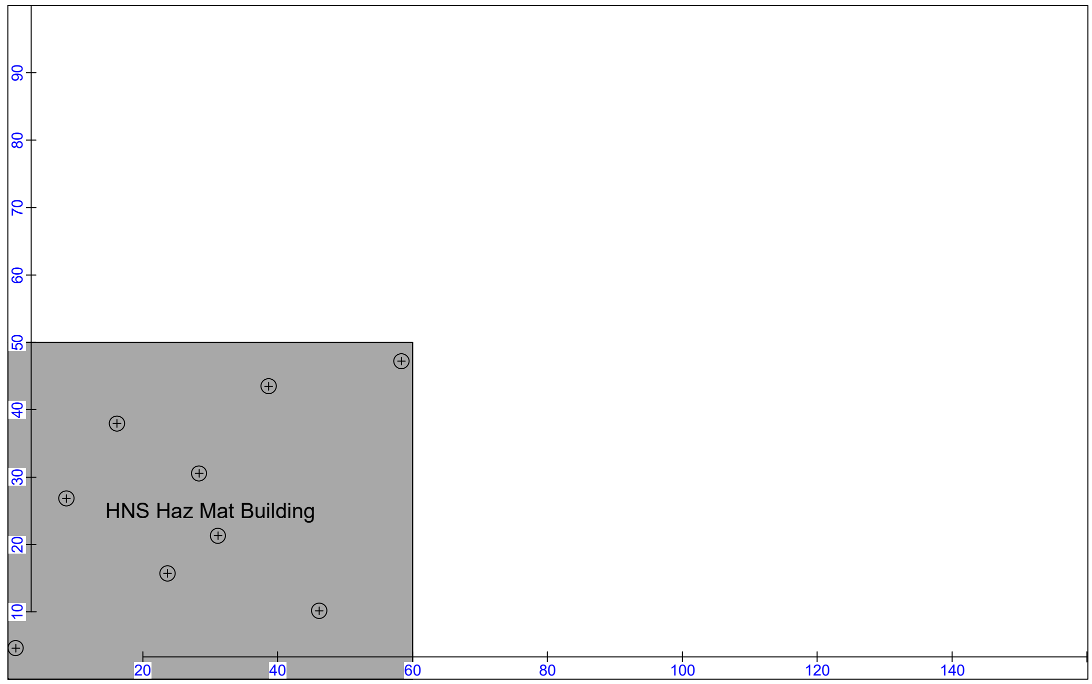
Random sampling locations for comparing a mean with a fixed threshold (nonparametric)

Summary
This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon signed ranks test
Calculated total number of samples	9
Number of samples on map [a]	9
Number of selected sample areas [b]	1
Specified sampling area [c]	3000.00 ft^2
Total cost of sampling [d]	$2,448.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: HNS Haz Mat Building										
X Coord	Y Coord	Z Coord	Label	Value	Type	Historical	Surface	LX	LY	Sample Area
28.3528	30.5440	0.0000			Random		Floor	28.3528	30.5440	
58.3528	47.2107	0.0000			Random		Floor	58.3528	47.2107	
1.1653	4.6181	0.0000			Random		Floor	1.1653	4.6181	
31.1653	21.2848	0.0000			Random		Floor	31.1653	21.2848	
16.1653	37.9514	0.0000			Random		Floor	16.1653	37.9514	
46.1653	10.1737	0.0000			Random		Floor	46.1653	10.1737	
8.6653	26.8403	0.0000			Random		Floor	8.6653	26.8403	
38.6653	43.5070	0.0000			Random		Floor	38.6653	43.5070	
23.6653	15.7292	0.0000			Random		Floor	23.6653	15.7292	

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

VSP offers many options to determine the locations at which measurements are made or samples are collected and subsequently measured. For this design, simple random point sampling was chosen. Locating the sample points randomly provides data that are separated by varying distances, providing good information about the spatial structure of the potential contamination. Knowledge of the spatial structure is useful for geostatistical analysis. However, it may not ensure that all portions of the site are equally represented.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Wilcoxon Signed Ranks test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S^2_{sample} + \dfrac{S^2_{analytical}}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z^2_{1-\alpha}\right]$$

where
n is the number of samples,
S is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the gray region,
α is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
β is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

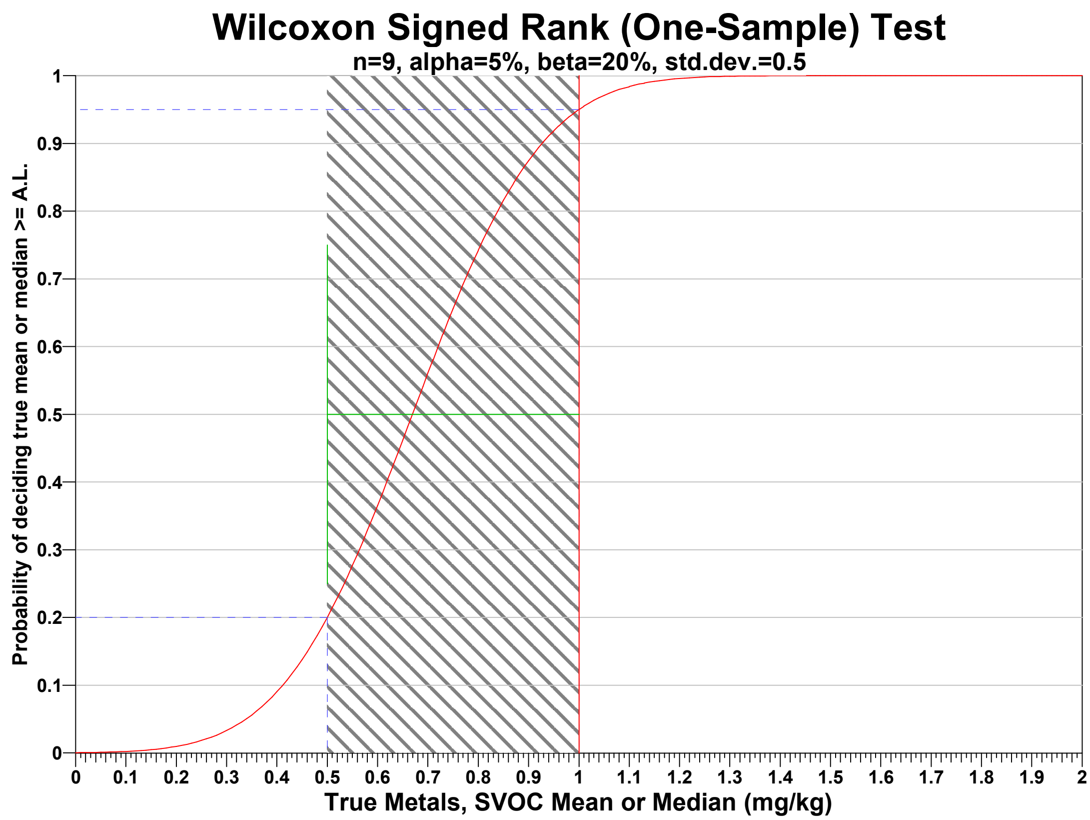
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	**n**	**Parameter**					
		S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
Metals, SVOC	9	0.5 mg/kg	0.5 mg/kg	0.05	0.2	1.64485	0.841621

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions
The assumptions associated with the formulas for computing the number of samples are:
1. the data originate from a symmetric (but not necessarily normal) population,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

Sensitivity Analysis
The sensitivity of the calculation of number of samples was explored by varying the standard deviation, delta, beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
		α=5		α=10		α=15	
		s=1	s=0.5	s=1	s=0.5	s=1	s=0.5
Δ=0.25	β=15	136	35	101	26	81	21
	β=20	117	31	85	22	67	17
	β=25	102	27	72	19	55	15
Δ=0.5	β=15	35	10	26	8	21	6
	β=20	31	9	22	7	17	5
	β=25	27	8	19	6	15	5
Δ=0.75	β=15	17	6	13	4	10	3
	β=20	15	5	11	4	8	3
	β=25	13	5	9	3	7	3

s = Standard Deviation
Δ = Delta
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level

Cost of Sampling

The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,448.00, which averages out to a per sample cost of $272.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**9 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (Metals, SVOC)	$272.00	$272.00	$2,448.00
Sum of Field & Analytical costs		**$272.00**	**$2,448.00**
Fixed planning and validation costs			$0.00
Total cost			**$2,448.00**

Recommended Data Analysis Activities

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

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* - The report contents may have been modified or reformatted by end-user of software.

Random sampling locations for comparing a mean with a fixed threshold (nonparametric)

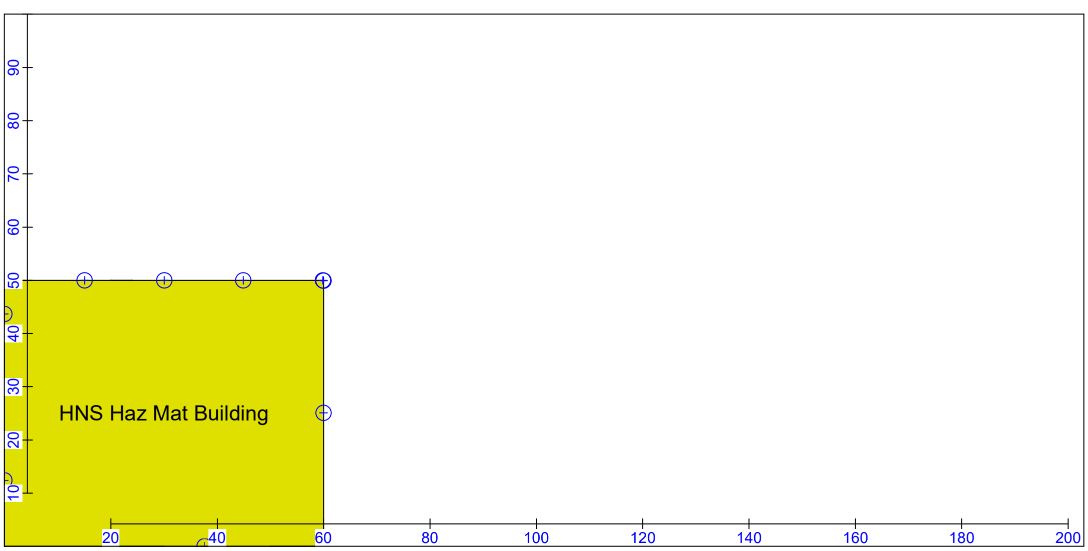
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon signed ranks test
Calculated total number of samples	9
Number of samples on map [a]	9
Number of selected sample areas [b]	1
Specified sampling area [c]	1773.33 ft^2
Total cost of sampling [d]	$2,448.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: HNS Haz Mat Building

X Coord	Y Coord	Z Coord	Label	Value	Type	Historical	Surface	LX	LY	Sample Area
37.6037	0.0000	4.2352			Random		Wall 4	22.3963	4.2352	
0.0000	43.6636	7.2352			Random		Wall 1	43.6636	7.2352	
0.0000	12.4136	2.2352			Random		Wall 1	12.4136	2.2352	
44.8963	50.0000	5.2352			Random		Wall 2	44.8963	5.2352	
60.0000	25.0864	8.2352			Random		Wall 3	24.9136	8.2352	
59.8963	50.0000	0.5685			Random		Wall 2	59.8963	0.5685	
60.0000	49.9399	3.5685			Random		Wall 3	0.0601	3.5685	
30.0721	50.0000	6.5685			Random		Wall 2	30.0721	6.5685	
15.0721	50.0000	1.5685			Random		Wall 2	15.0721	1.5685	

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

VSP offers many options to determine the locations at which measurements are made or samples are collected and subsequently measured. For this design, simple random point sampling was chosen. Locating the sample points randomly provides data that are separated by varying distances, providing good information about the spatial structure of the potential contamination. Knowledge of the spatial structure is useful for geostatistical analysis. However, it may not ensure that all portions of the site are equally represented.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Wilcoxon Signed Ranks test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S_{sample}^2 + \frac{S_{analytical}^2}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5 Z_{1-\alpha}^2\right]$$

where
n is the number of samples,
S is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the gray region,
α is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,

β is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

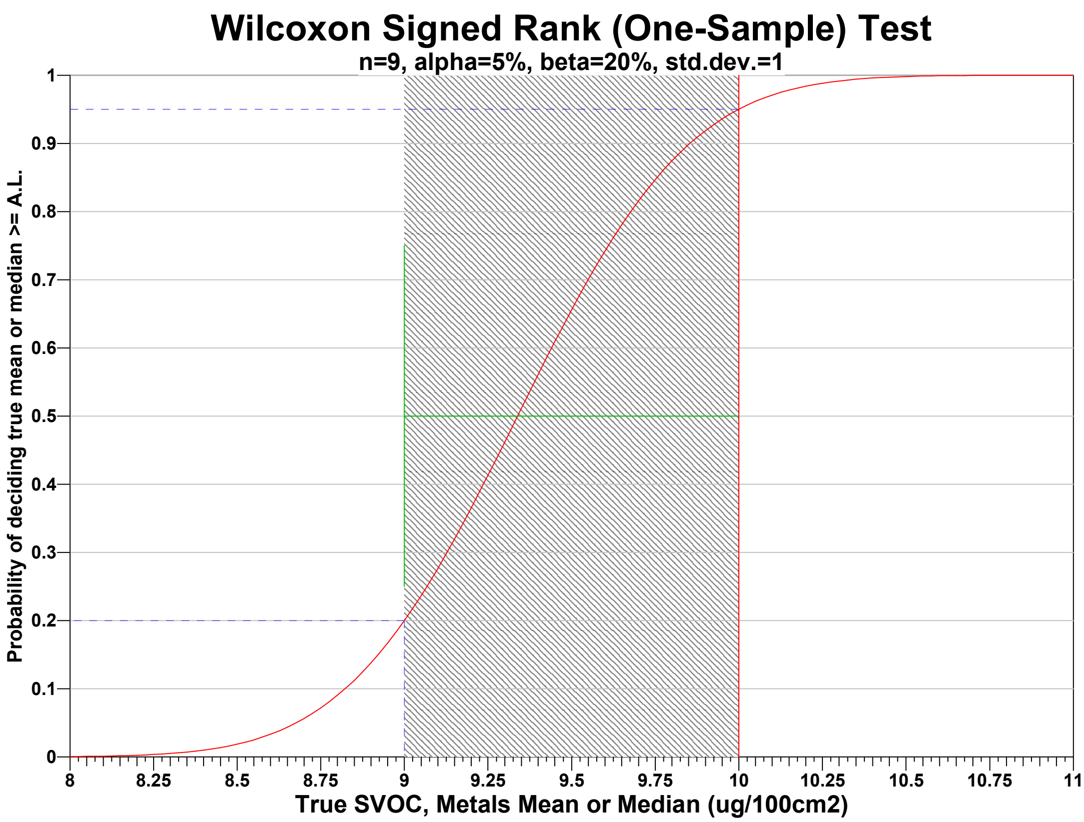
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n	Parameter					
		S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
SVOC, Metals	9	1 ug/100cm2	1 ug/100cm2	0.05	0.2	1.64485	0.841621

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions
The assumptions associated with the formulas for computing the number of samples are:
1. the data originate from a symmetric (but not necessarily normal) population,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and

4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, delta, beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
		α=5		**α=10**		**α=15**	
		s=2	**s=1**	**s=2**	**s=1**	**s=2**	**s=1**
Δ=0.5	**β=15**	136	35	101	26	81	21
	β=20	117	31	85	22	67	17
	β=25	102	27	72	19	55	15
Δ=1	**β=15**	35	10	26	8	21	6
	β=20	31	9	22	7	17	5
	β=25	27	8	19	6	15	5
Δ=1.5	**β=15**	17	6	13	4	10	3
	β=20	15	5	11	4	8	3
	β=25	13	5	9	3	7	3

s = Standard Deviation
Δ = Delta
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level

Cost of Sampling

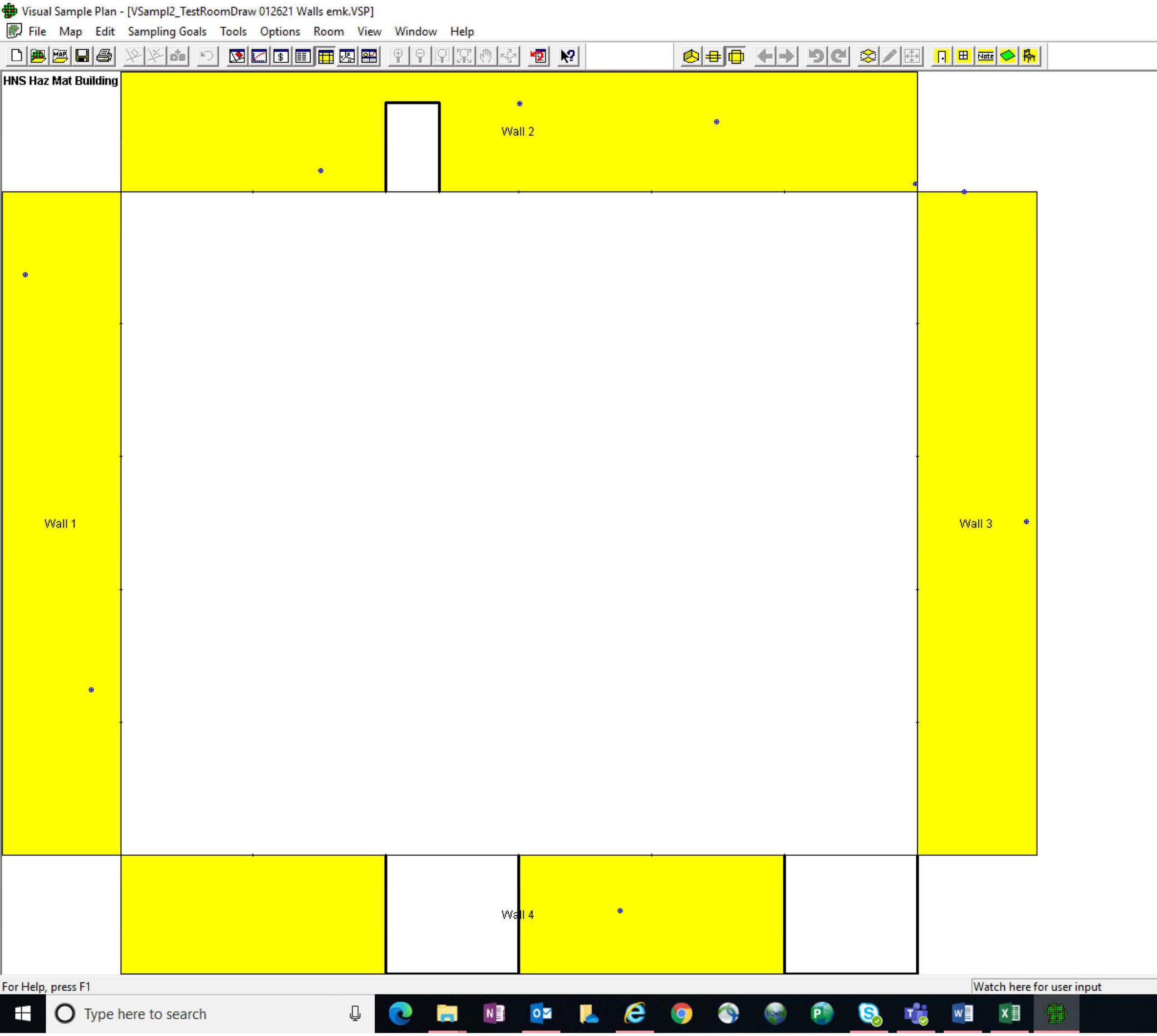
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,448.00, which averages out to a per sample cost of $272.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**9 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (SVOC, Metals)	$272.00	$272.00	$2,448.00
Sum of Field & Analytical costs		**$272.00**	**$2,448.00**
Fixed planning and validation costs			$0.00
Total cost			**$2,448.00**

Recommended Data Analysis Activities

Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.


Visual Sample Plan - [VSampl2_TestRoomDraw 012621 Walls emk.VSP]
File Map Edit Sampling Goals Tools Options Room View Window Help
HNS Haz Mat Building
Wall 2
Wall 1
Wall 3
Wall 4
For Help, press F1
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Systematic sampling locations for comparing a mean with a fixed threshold (nonparametric)

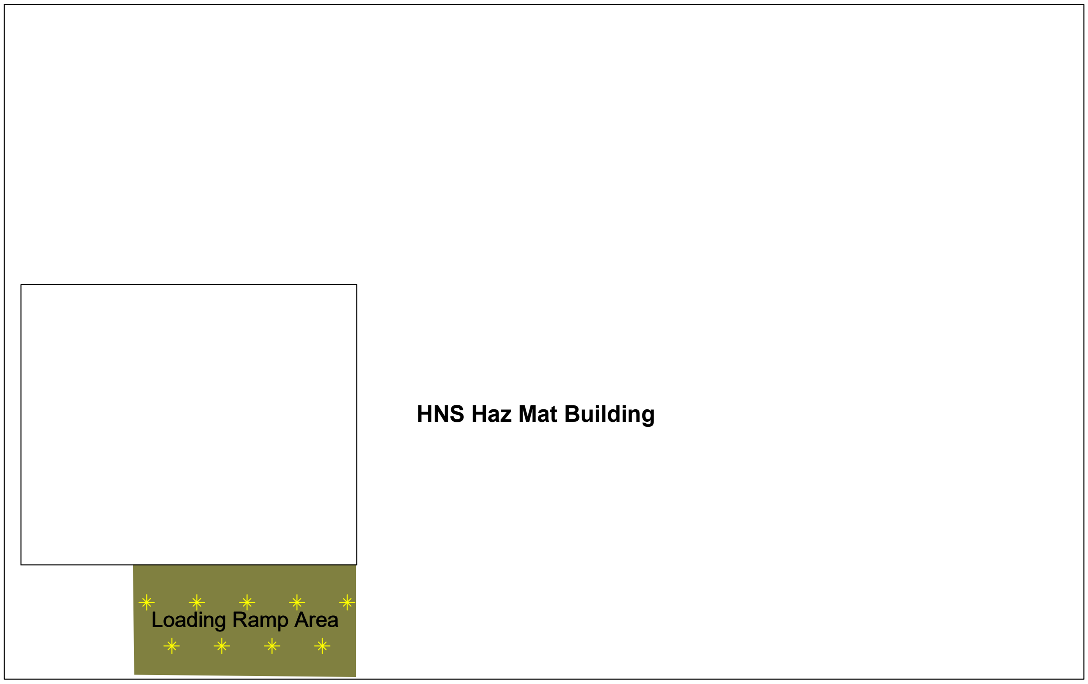
Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Systematic grid with a random start location
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon signed ranks test
Calculated total number of samples	9
Number of samples on map [a]	9
Number of selected sample areas [b]	1
Specified sampling area [c]	789.66 ft^2
Size of grid / Area of grid cell [d]	8.94707 feet / 69.3255 ft^2
Grid pattern	Triangular
Total cost of sampling [e]	$2,988.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Size of grid / Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.
[e] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Loading Ramp Area						
X Coord	Y Coord	Label	Value	Type	Historical	Sample Area
26.9414	-14.4582			Systematic		
35.8885	-14.4582			Systematic		
44.8356	-14.4582			Systematic		
53.7827	-14.4582			Systematic		
22.4679	-6.7098			Systematic		
31.4150	-6.7098			Systematic		
40.3620	-6.7098			Systematic		
49.3091	-6.7098			Systematic		
58.2562	-6.7098			Systematic		

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A nonparametric systematic sampling approachwith a random start was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

VSP offers many options to determine the locations at which measurements are made or samples are collected and subsequently measured. For this design, systematic grid point sampling was chosen. Locating the sample points systematically provides data that are all equidistant apart. This approach does not provide as much information about the spatial structure of the potential contamination as simple random sampling does. Knowledge of the spatial structure is useful for geostatistical analysis. However, it ensures that all portions of the site are equally represented. Statistical analyses of systematically collected data are valid if a random start to the grid is used.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Wilcoxon Signed Ranks test. For this site, the null hypothesis is rejected in favor of the alternative one if the sample median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S^2_{sample} + \frac{S^2_{analytical}}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z^2_{1-\alpha}\right]$$

where

n	is the number of samples,
S	is the estimated standard deviation of the measured values including analytical error,
Δ	is the width of the gray region,
α	is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
β	is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is 1-α,
$Z_{1-\beta}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is 1-β.

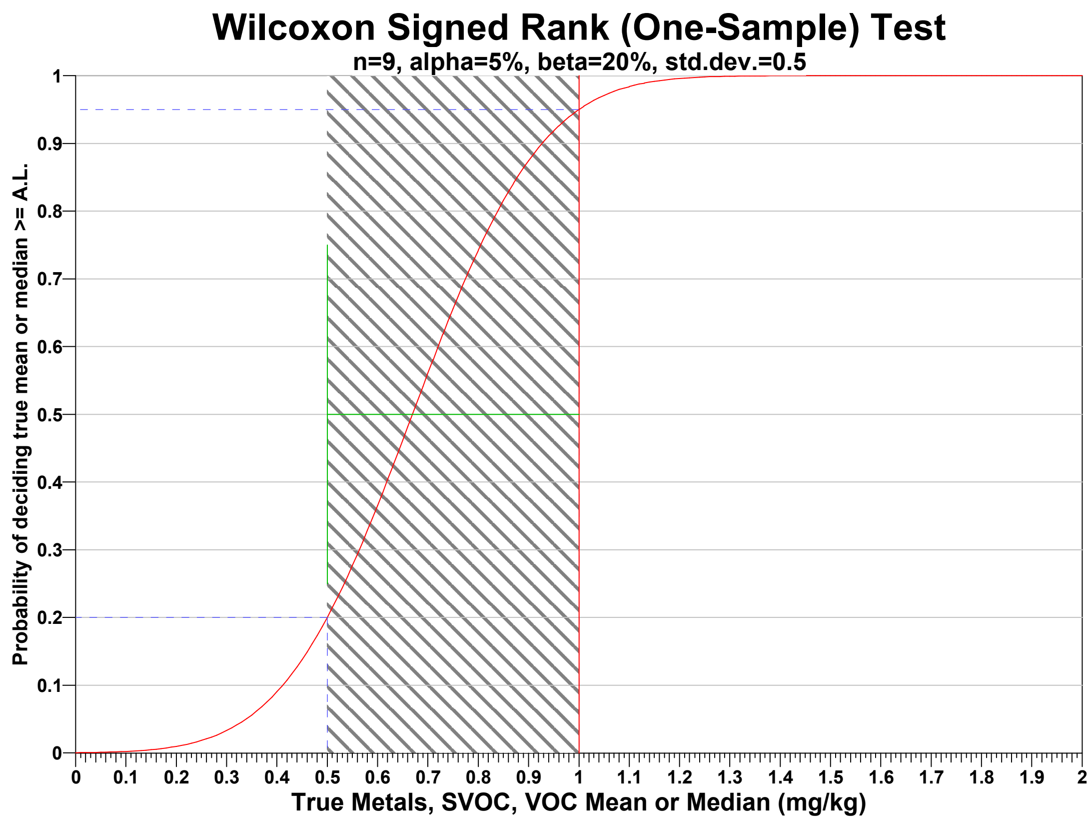
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	n	Parameter					
		S	Δ	α	β	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
Metals, SVOC, VOC	9	0.5 mg/kg	0.5 mg/kg	0.05	0.2	1.64485	0.841621

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at 1-α on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at 1-α. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the data originate from a symmetric (but not necessarily normal) population,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
AL=1		α=5		α=10		α=15	
		s=1	s=0.5	s=1	s=0.5	s=1	s=0.5
LBGR=90	β=15	836	211	625	157	500	126
	β=20	719	181	524	132	410	103
	β=25	626	158	445	112	341	86
LBGR=80	β=15	211	54	157	40	126	32
	β=20	181	47	132	34	103	27
	β=25	158	41	112	29	86	22
LBGR=70	β=15	95	25	71	19	57	15
	β=20	82	22	60	16	47	12
	β=25	71	19	51	14	39	11

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $2,988.00, which averages out to a per sample cost of $332.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**9 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (Metals, SVOC, VOC)	$332.00	$332.00	$2,988.00
Sum of Field & Analytical costs		**$332.00**	**$2,988.00**
Fixed planning and validation costs			$0.00
Total cost			**$2,988.00**

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

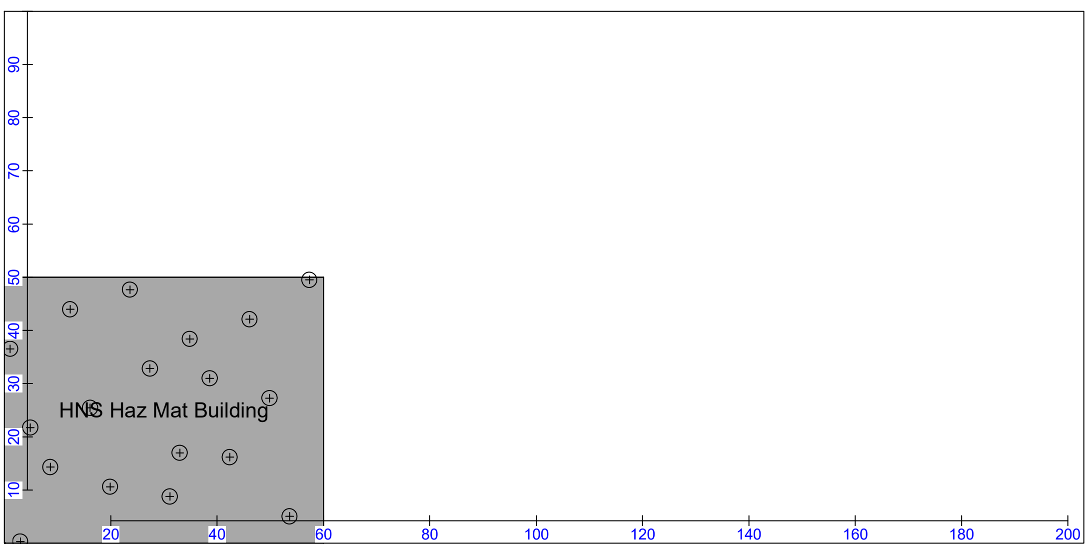
Predetermined Number of Random Sampling Locations

Summary
This report summarizes the sampling design, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	User Defined
Sample Placement (Location) in the Field	Simple random sampling
User specified number of samples	18
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	3000.00 ft^2
Total cost of sampling [d]	$4,896.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: HNS Haz Mat Building										
X Coord	Y Coord	Z Coord	Label	Value	Type	Historical	Surface	LX	LY	Sample Area
1.1031	36.5341	0.0000			Random		Floor	1.1031	36.5341	
31.1031	8.7563	0.0000			Random		Floor	31.1031	8.7563	

16.1031	25.4230	0.0000			Random		Floor	16.1031	25.4230	
46.1031	42.0897	0.0000			Random		Floor	46.1031	42.0897	
8.6031	14.3119	0.0000			Random		Floor	8.6031	14.3119	
38.6031	30.9785	0.0000			Random		Floor	38.6031	30.9785	
23.6031	47.6452	0.0000			Random		Floor	23.6031	47.6452	
53.6031	5.0526	0.0000			Random		Floor	53.6031	5.0526	
4.8531	21.7193	0.0000			Random		Floor	4.8531	21.7193	
34.8531	38.3860	0.0000			Random		Floor	34.8531	38.3860	
19.8531	10.6082	0.0000			Random		Floor	19.8531	10.6082	
49.8531	27.2748	0.0000			Random		Floor	49.8531	27.2748	
12.3531	43.9415	0.0000			Random		Floor	12.3531	43.9415	
42.3531	16.1637	0.0000			Random		Floor	42.3531	16.1637	
27.3531	32.8304	0.0000			Random		Floor	27.3531	32.8304	
57.3531	49.4971	0.0000			Random		Floor	57.3531	49.4971	
2.9781	0.3201	0.0000			Random		Floor	2.9781	0.3201	
32.9781	16.9868	0.0000			Random		Floor	32.9781	16.9868	

Primary Sampling Objective
The primary purpose of sampling at this site is unknown to Visual Sample Plan. The number of samples may have been calculated in another sampling design in Visual Sample Plan, or may have been calculted externally to VSP. Alternatively, the purpose may be based entirely on professional judgment.

Selected Sampling Approach
Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $4,896.00, which averages out to a per sample cost of $272.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**18 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (Metals, SVOC)	$272.00	$272.00	$4,896.00
Sum of Field & Analytical costs		**$272.00**	**$4,896.00**
Fixed planning and validation costs			$0.00
Total cost			**$4,896.00**

Further Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve

a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Predetermined Number of Random Sampling Locations

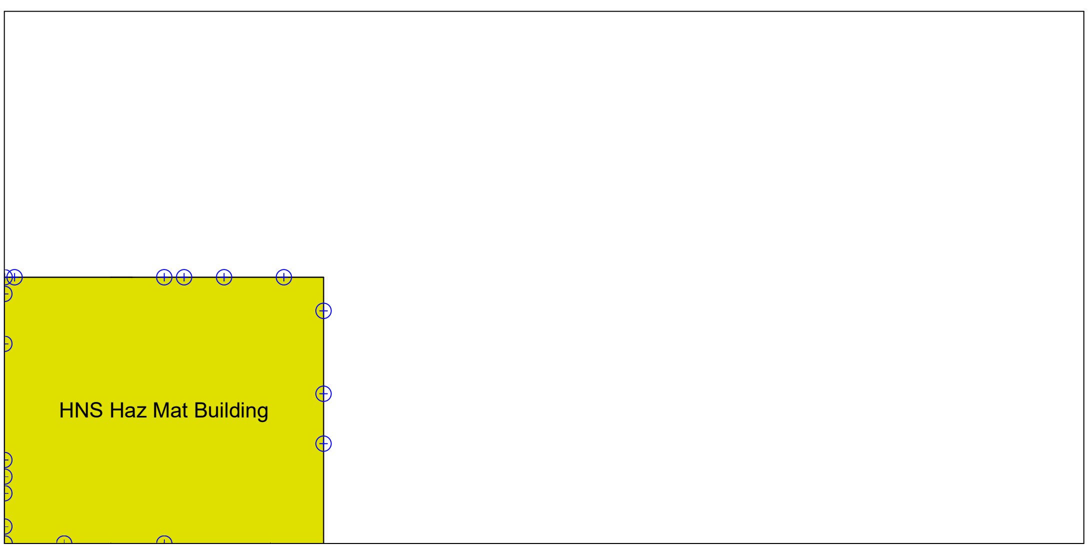
Summary

This report summarizes the sampling design, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	User Defined
Sample Placement (Location) in the Field	Simple random sampling
User specified number of samples	18
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	1773.33 ft^2
Total cost of sampling [d]	$4,896.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: HNS Haz Mat Building										
X Coord	Y Coord	Z Coord	Label	Value	Type	Historical	Surface	LX	LY	Sample Area
30.0542	0.0000	4.9383			Random		Wall 4	29.9458	4.9383	
0.0542	0.0000	7.9383			Random		Wall 4	59.9458	7.9383	

0.0337	50.0000	2.9383			Random		Wall 2	0.0337	2.9383	
30.0337	50.0000	5.9383			Random		Wall 2	30.0337	5.9383	
0.0000	12.5281	8.9383			Random		Wall 1	12.5281	8.9383	
0.0000	37.5281	0.0864			Random		Wall 1	37.5281	0.0864	
60.0000	43.7219	3.0864			Random		Wall 3	6.2781	3.0864	
60.0000	18.7219	6.0864			Random		Wall 3	31.2781	6.0864	
52.5337	50.0000	4.0864			Random		Wall 2	52.5337	4.0864	
0.0000	3.1531	7.0864			Random		Wall 1	3.1531	7.0864	
33.7837	50.0000	2.0864			Random		Wall 2	33.7837	2.0864	
0.0000	15.6531	5.0864			Random		Wall 1	15.6531	5.0864	
11.2163	0.0000	8.0864			Random		Wall 4	48.7837	8.0864	
0.0000	9.4031	0.4197			Random		Wall 1	9.4031	0.4197	
41.2837	50.0000	3.4197			Random		Wall 2	41.2837	3.4197	
60.0000	28.0969	6.4197			Random		Wall 3	21.9031	6.4197	
0.0000	46.9031	1.4197			Random		Wall 1	46.9031	1.4197	
1.9087	50.0000	4.4197			Random		Wall 2	1.9087	4.4197	

Primary Sampling Objective
The primary purpose of sampling at this site is unknown to Visual Sample Plan. The number of samples may have been calculated in another sampling design in Visual Sample Plan, or may have been calculted externally to VSP. Alternatively, the purpose may be based entirely on professional judgment.

Selected Sampling Approach
Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $4,896.00, which averages out to a per sample cost of $272.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**18 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (SVOC, Metals)	$272.00	$272.00	$4,896.00
Sum of Field & Analytical costs		**$272.00**	**$4,896.00**
Fixed planning and validation costs			$0.00
Total cost			**$4,896.00**

Further Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to

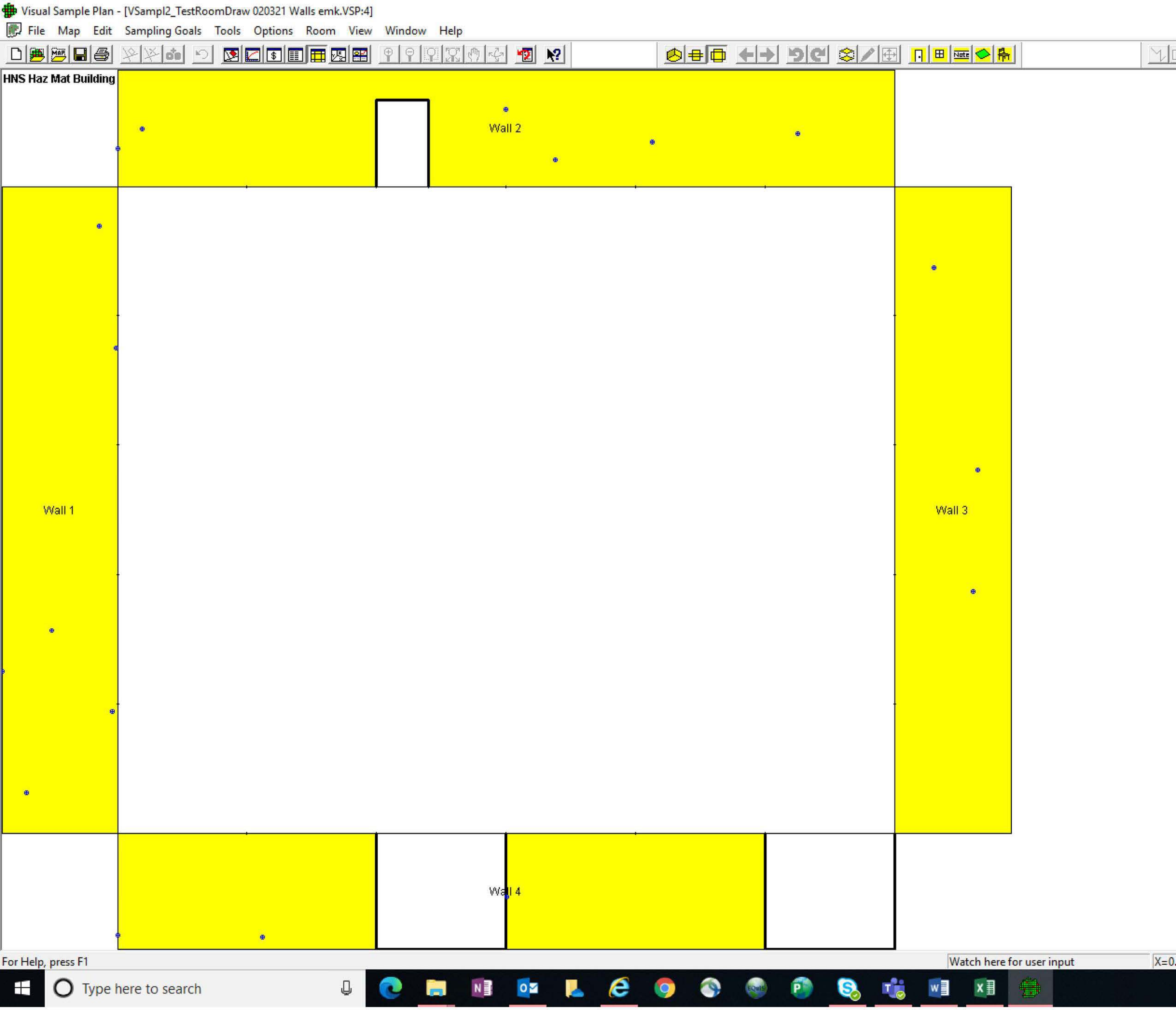
achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

This report was automatically produced* by Visual Sample Plan (VSP) software version 7.15.

This design was last modified 2/3/2021 1:57:52 PM.

Software and documentation available at http://vsp.pnnl.gov

* - The report contents may have been modified or reformatted by end-user of software.


Visual Sample Plan - [VSampl2_TestRoomDraw 020321 Walls emk.VSP:4]
File Map Edit Sampling Goals Tools Options Room View Window Help
HNS Haz Mat Building
Wall 2
Wall 1
Wall 3
Wall 4
For Help, press F1
Watch here for user input
Type here to search

Predetermined Number of Systematic Sampling Locations

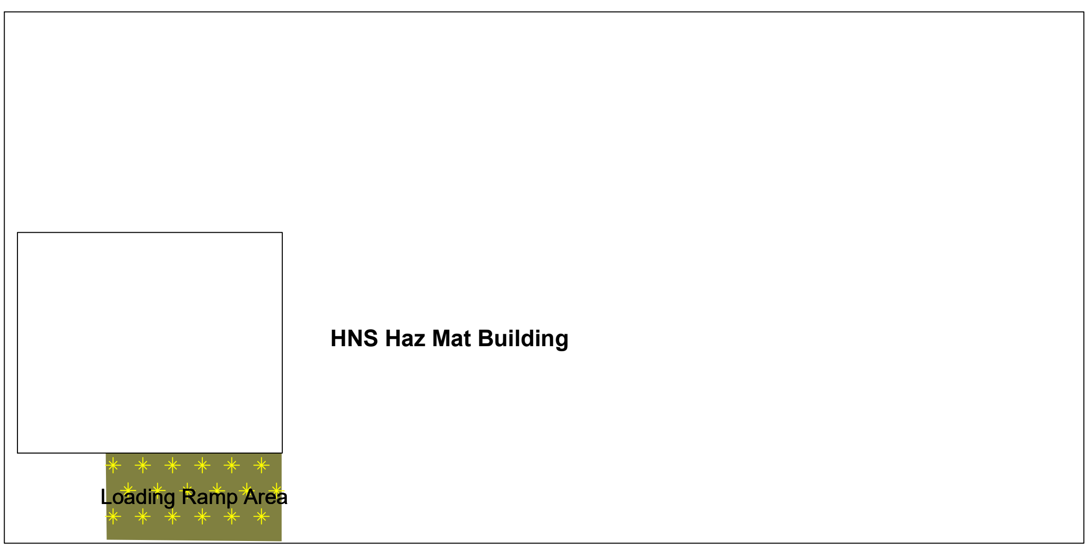
Summary

This report summarizes the sampling design, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	User Defined
Sample Placement (Location) in the Field	Systematic with a random start location
User specified number of samples	18
Number of samples on map [a]	18
Number of selected sample areas [b]	1
Specified sampling area [c]	789.66 ft^2
Size of grid / Area of grid cell [d]	6.72195 feet / 39.131 ft^2
Grid pattern	Triangular
Total cost of sampling [e]	$5,976.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Size of grid / Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.
[e] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Loading Ramp Area						
X Coord	Y Coord	Label	Value	Type	Historical	Sample Area

21.6450	-14.3043			Systematic		
28.3669	-14.3043			Systematic		
35.0889	-14.3043			Systematic		
41.8108	-14.3043			Systematic		
48.5328	-14.3043			Systematic		
55.2547	-14.3043			Systematic		
25.0060	-8.4829			Systematic		
31.7279	-8.4829			Systematic		
38.4498	-8.4829			Systematic		
45.1718	-8.4829			Systematic		
51.8937	-8.4829			Systematic		
58.6157	-8.4829			Systematic		
21.6450	-2.6616			Systematic		
28.3669	-2.6616			Systematic		
35.0889	-2.6616			Systematic		
41.8108	-2.6616			Systematic		
48.5328	-2.6616			Systematic		
55.2547	-2.6616			Systematic		

Primary Sampling Objective
The primary purpose of sampling at this site is unknown to Visual Sample Plan. The number of samples may have been calculated in another sampling design in Visual Sample Plan, or may have been calculted externally to VSP. Alternatively, the purpose may be based entirely on professional judgment.

Selected Sampling Approach
Locating the sample points over a systematic grid with a random start ensures spatial coverage of the site. Statistical analyses of systematically collected data are valid if a random start to the grid is used. One disadvantage of systematically collected samples is that spatial variability or patterns may not be discovered if the grid spacing is large relative to the spatial patterns.

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $5,976.00, which averages out to a per sample cost of $332.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**18 Samples**
Field collection costs		$0.00	$0.00
Analytical costs (Metals, SVOC, VOC)	$332.00	$332.00	$5,976.00
Sum of Field & Analytical costs		**$332.00**	**$5,976.00**
Fixed planning and validation costs			$0.00
Total cost			**$5,976.00**

Further Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The

data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.